

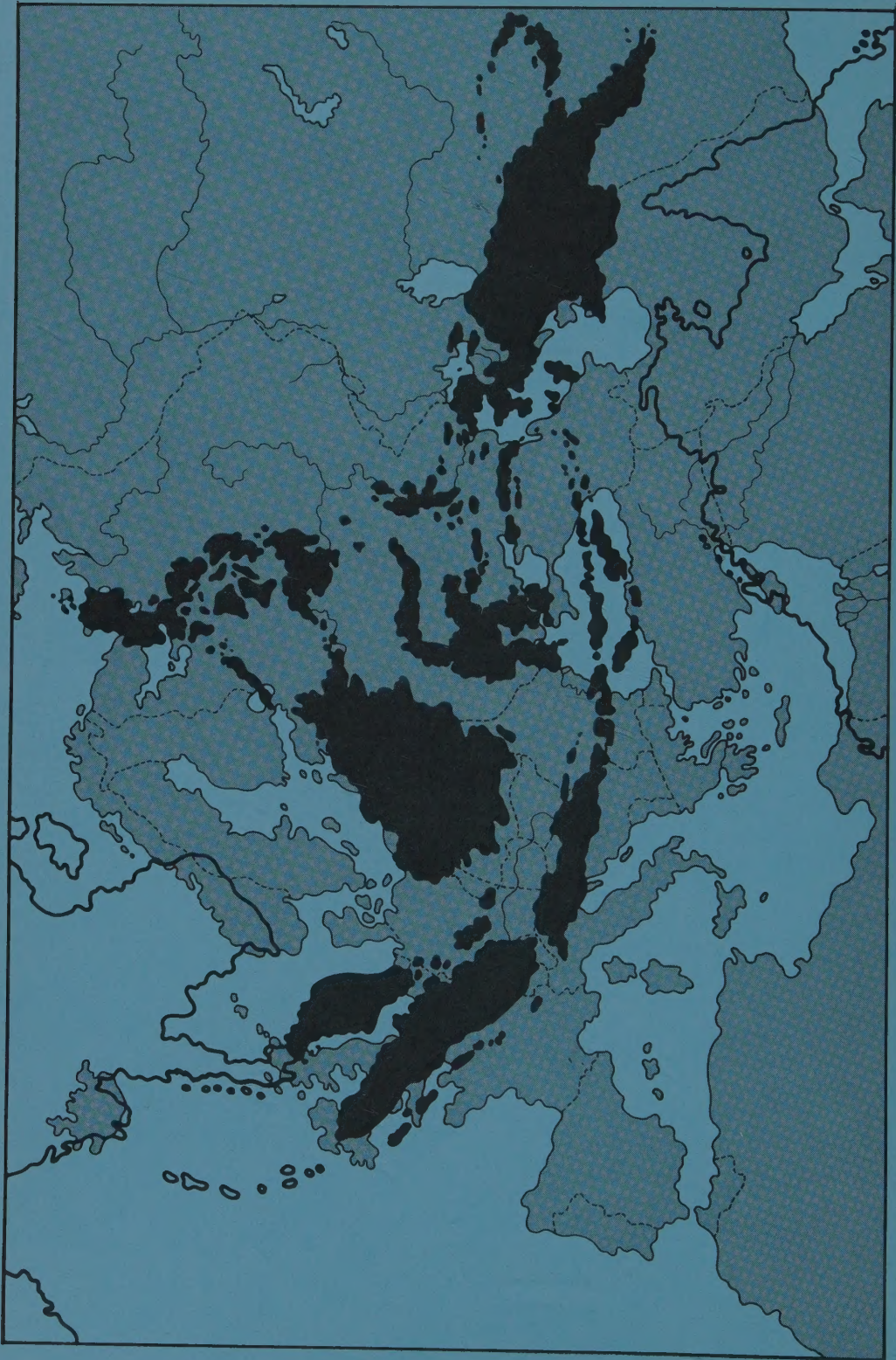
# FLORA MALESIANA

SERIES I – SPERMATOPHYTA

*Flowering Plants*

Volume 11, part 1

*Mimosaceae (Leguminosae–Mimosoideae)*





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## Mimosaceae (Leguminosae—Mimosoideae)

by

I. C. Nielsen

(treatment of *Parkia* by H. C. Fortune Hopkins)

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## MIMOSACEAE (LEGUMINOSAE – MIMOSOIDEAE)<sup>1</sup>

(I.C. Nielsen<sup>2</sup>, Aarhus, Denmark; H.C. Fortune Hopkins<sup>3</sup>, Chatham-Maritime, U.K.)

Trees, shrubs or lianas, very rarely herbs (*Neptunia* and *Mimosa* p.p.); branches unarmed or armed with stipular thorns (rarely axillary thorns) or scattered prickles on the internodes. Stipules rarely absent, usually caducous. *Leaves* alternate, usually bipinnate (unipinnate in *Inga*, transformed into phyllodes in *Acacia* subg. *Phyllodineae*), usually provided with extrafloral nectaries on rachis and pinnae. *Inflorescences* bracteate, simple or compound, racemose; inflorescence units usually consisting of pedunculate glomerules, spikes or spike-like racemes, which are aggregated into axillary or terminal panicles. Pedicels usually short or absent. *Flowers* actinomorphic, bisexual, unisexual, or rarely neuter, usually small and white, greenish or yellow. Disk, when present, intrastaminal. *Stamens* few to numerous, free or united into a tube, the latter sometimes united with the corolla-tube at the base. Anthers dorsifixed,  $\pm$  quadrangular in outline, sometimes with a small, caducous gland at the apex. Ovary(-ies) solitary (to several and free), superior, 1-celled; style filiform; stigma small, tubular(-infundibular), terminal. Ovules anatropous, parietal. *Fruit* a pod, dehiscent or indehiscent, sometimes breaking into 1-seeded segments. *Seeds* usually in two rows from the single placenta, inserted transversely, obliquely or longitudinally, mostly ovate-orbicular in outline, often compressed; funicle rarely developed into an aril (*Acacia* p.p., *Pithecellobium*); the testa osseous, coriaceous or chartaceous usually with a  $\pm$  peripheral furrow, the pleurogram.

Distribution — About 60 genera and some 3000 species, mainly in the tropics and the subtropics, but some genera (e.g. *Acacia* and *Albizia*) extending into the warm-temperate zone; in *Malesia*: 19 genera, of which 15 native, with 1 endemic, viz. *Wallaceodendron* in N Celebes and the Philippines. Among the remaining 14 native genera, 5 are pantropical (*Acacia*, *Albizia*, *Entada*, *Neptunia*, *Parkia*), 3 are shared with continental S Asia and tropical N Australia (*Adenanthera*, *Archidendron*, *Cathormion*), 2 with Melanesia and the west Pacific (*Schleinitzia*, *Serianthes*), 2 with Australia (*Pararchidendron*, *Paraserianthes*), 1 with New Caledonia, the Solomon Islands and Australia (*Archidendropsis*), and 1 with India and tropical Africa/Madagascar (*Dichrostachys*). The total number of native and naturalized species is c. 150. Furthermore, an enumeration of c. 45 cultivated species is given at the end of this revision (p. 205). In both Keys to the genera 7 commonly cultivated genera are included.

In the family *Mimosaceae* tropical Asia and Australia have close affinities, a number of species being common to E Malesia and tropical (to subtropical) Australia. The links be-

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3) Revision of the genus *Parkia*.



tween Asia and Africa are weak, although a few species (*Acacia nilotica*, *Dichrostachys cinerea*, *Entada rheedii*) and a part of the very diversified genus *Calliandra* are common to both continents. Other links between Asia and Africa are *Xylia* from India / Burma to Thailand/Indochina and the rest of the species in Africa / Madagascar and the genera of the *Adenanthera* group, *Adenanthera* being endemic to Asia – Australia and *Tetrapleura* and *Amblygonocarpus* to tropical Africa. The only generic tie between Asia and tropical America is the not yet fully understood *Havardia*: 3 species in mainland Asia, the remaining c. 20 in Central and N tropical South America (Nielsen 1981). More distantly related 'sister groups' are *Archidendron*, which is related to the tropical American genus *Cajoba* (Nielsen et al. 1984), and *Schleinitzia* with the American genus *Leucaena* (Lewis & Elias 1982). Africa and America share only 2 non-pantropical genera, 12 genera being endemic to Africa/Madagascar and 27 to America. *Indopiptadenia* is the only genus endemic to mainland Asia.

A few species-rich genera as *Acacia* (more than 1300 species), *Calliandra* (c. 200), *Inga* (c. 350), and *Mimosa* (c. 400) account for the major part of the diversity, a fact that cannot be explained by differences in generic concepts alone; it is a testimony that adaptive radiations have taken place in Australia (*Acacia*) and in South America (*Calliandra*, *Inga*, *Mimosa*). The number of monotypic genera is low; in Malesia: *Wallaceodendron*; in Malesia/Australia: *Pararchidendron*; in India: *Indopiptadenia*; in Africa/Madagascar 5, and in America 6 genera.

The family, with five pantropical genera, thus displays a complicated distribution pattern of widely distributed genera and narrowly distributed relictual ones. The first genera evolved are probably those of the tribe *Mimoseae*, the centre of origin being Africa/America, and the tribe *Parkieae*. Then *Acacia* developed in the everwet tropics from ancestors like subg. *Aculeiferum*, being followed by the evolution of *Acacia* subg. *Acacia* and subg. *Phyllodineae* in the arid areas of the tropics and subtropics. Tribe *Ingeae* has two centres of evolution, both in the everwet tropics, one in tropical Central/South America and one in tropical Asia/W Pacific.

*References:* Lewis, G.P. & T.S. Elias, in R.M. Polhill & P.H. Raven (eds.), *Advances in Legume Systematics* 1, Roy. Bot. Gard. Kew (1981) 167. — Nielsen, I., in Polhill & Raven (eds.), l.c. (1981) 184. — Nielsen, I., T. Baretta-Kuipers & Ph. Guinet, *Opera Bot.* 76 (1984) 5–120.

**Habitat & Ecology** — Members of the subfamily occur in a fairly high diversity of habitats, though upper montane and alpine species are absent except for *Paraserianthes lophantha* subsp. *montana* var. *montana*, which is recorded from sites up to 3265 m on the Javanese volcanoes. Quite a few genera have species that are adapted to arid conditions; here they are prominent members of the savanna and woodland associations (e.g. *Acacia* p.p. in Asia, Africa and Australia, *Dichrostachys* and *Prosopis* in America and Africa, and in subtropical W Asia *Albizia* p.p., the extreme case being *Elephanthorrhiza* of southern Africa, where some of the species develop annual aerial shoots from a woody subterranean stem). The only truly aquatic member of the subfamily is *Neptunia oleracea*. Most of the species of the *Mimosaceae* are sun-loving and found in open habitats such as deciduous forests, woodlands, and savannas. Almost all species of tribe *Ingeae* are found in lowland evergreen forests. They are often found in clearings and in gallery



forest along rivers (many species of *Inga* and *Zygia* in the Amazonian rain forests), although some species, e.g. *Archidendron fagifolium* and *A. jiringa*, are understorey trees. Some species occur in as tall emergent rain forest trees (e.g. *Adenanthera* p.p., *Parkia* p.p., the South American *Cedrelinga* and *Inga* p.p., and in Malesia *Albizia rosulata*, *A. pedicellata* and *A. splendens*).

*Habit.* The majority of the Malesian genera are shrubs or small to large trees. Herbs are represented by the genera *Neptunia* and *Mimosa* p.p. Climbers are found in *Acacia* subg. *Aculeiferum*, in 3 species of the genus *Albizia*, *A. corniculata*, *A. myriophylla*, and *A. rufa*, and in *Entada*. Oldeman (1989) gave an account on the biological implications of leguminous tree architecture. *Acacia auriculiformis* as studied in Indonesia by Edelin (1984) has as a young tree a monopodial, orthotropic trunk. When having reached a certain developmental stage (which may vary considerably according to age and size of the trees), the original model is reiterated at the place of certain branches, the apical meristems of which begin to function accordingly. When the tree grows still higher, the extremity of the original trunk bends over, height growth is taken over by one of the branched models somewhere on the curved trunk, and this process continues (Oldeman l.c.). It is concluded that the complex and flexible architecture of leguminous trees allows them to survive in complex and unstable environments. An example of a species that remains unbranched throughout its lifetime is *Archidendron glabrum* (Hallé et al. 1978, sub *Pithecellobium hansemannii*).

*Dominance.* Almost all species occur scattered in their habitats. An exception is *Neptunia oleracea*, which may form large floating islands in rivers and ponds. The naturalized species of *Mimosa* are very common weeds along roads, on waste places, etc., and the ligneous *Leucaena leucocephala* may show weedy tendencies as well. *Paraserianthes lophantha* subsp. *montana* var. *montana* forms monospecific stands in the montane forest on the Javanese volcanoes, the germination of the seeds being stimulated by fires or acids from the solfataras (Van Steenis 1972). Tall tree specimens of *Parkia speciosa* and *P. timoriana* can be seen in the fields in the Malay Peninsula as old forest remnants. Some of the water-dispersed species (*Schleinitzia insularum*, *Serianthes grandiflora*) are often found in coastal associations (not in mangrove). In the Malay Peninsula *Adenanthera pavonina* is found in similar habitats. Some species (e.g. those of *Archidendron* ser. *Stipulatae*) are probably genuinely rare.

*Nodulation and mycorrhizas.* Root nodules with nitrogen fixing *Rhizobium* bacteria are frequent in the *Mimosaceae* (Corby 1981), where the astragaloid type of nodule is common. Also Sprent et al. (1989) found that the *Mimosaceae* on nodule characters are rather uniform, although *Parkia* was found to be aberrant. In the same volume Alexander (1989) gave a review on the occurrence of ectomycorrhizas. These are associated with woody species and have been reported from *Acacia*, *Inga* and *Mimosa*. Many other genera were reported to have vesicular-arbuscular (V-A) mycorrhizas. The data have been obtained from studies on American, African and Australian species.

*Flower biology.* The flowers of the *Mimosaceae* are usually placed in dense, many-flowered inflorescences such as heads, glomerules, spikes, or racemes, which are aggregated into axillary or terminal synflorescences. Some of the rain forest species are cauliflorous (American *Zygia* and *Inga* p.p. and Malesian *Archidendron*). The inflorescences



are racemose. The for pollinators visually attractive part of the flower is formed by the stamens, which are either white, yellow, pink, or reddish. In some genera there is a division of functions within parts of the inflorescence. This division is most extreme in *Parkia* (p. 194), where the pear-shaped heads have sterile flowers with staminodes in the proximal part, male flowers in the central part and bisexual flowers in the central and distal parts. In *Dichrostachys* and *Neptunia* the long yellow or red staminodes of the proximal, neuter flowers constitute the attractive part of the inflorescence contrasting with the yellow stamens. In *Neptunia oleracea* the inflorescence is erect first, but when the lower sterile flowers are developing the yellow staminodes the inflorescence bends over at a point of articulation on the peduncle. The attractive staminodes are expanded above the fertile flowers and a gradation occurs through male flowers to fully bisexual ones at the apex (Schrire 1989). The same process can be observed in *Dichrostachys cinerea*. The differences in flower function may be subtle. In *Acacia nilotica* more than 2/3 of the flowers within a glomerule are male (Tybirk 1989). In the major part of the genus *Albizia* the central flower of the glomerule is larger, with strongly exerted staminal tube, and it has a large ring-shaped nectary around the base of the gynoeceum, apparently constituting the for pollinators attractive element of the glomerule. The stigmas are generally cup-shaped, funnel-shaped or tubular and the 4–64-celled polyads of pollen fit into the stigma. In Australian *Acacia* the flowers are generally protogynous. The cup- or funnel-shaped stigmas are of the wet non-papillate type. A single compound pollen grain usually fits into the stigma cavity. A post-pollination exudate is produced on the stigma within 30 minutes after pollination. The polyads float on this fluid, and, by surface tension, a single polyad generally fits into the cup (Kenrick & Knox 1989). Only a small portion of the flowers develops into fruits. Tybirk (l.c.), in a recent study of *Acacia nilotica* in Kenya, found that the pod set per bisexual flower is 0.3%. Only a certain portion of ovules within a single flower develops into seeds. Bawa & Buckley (1989) gave an account on the seed:ovule ratios, selective seed abortion and mating systems in 5 species of American *Mimosaceae*. The seed:ovule ratios ranged from 0.66–1.0, being highest in *Mimosa pigra* and *M. pusilla*, the first being a self-compatible shrub occurring in gregarious stands, the latter being a small herb forming dense colonies in old fields. In the outcrossing species *Enterolobium cyclocarpum* and *Samanea saman* the number of pollen grains per polyad exceeded the number of ovules per ovary. Multiple polyad pollinations were also observed, whereas the number of pollen grains per polyad exactly corresponds with the number of ovules per ovary only in the presumably highly inbred *Mimosa pusilla*. In *Mimosa pigra*, where polyads are also 4-grained, but the number of ovules per ovary is 24, multiple pollination is supposed to obtain the high seed:ovule ratio of  $0.92 \pm 0.03$ . Mimosoid seed:ovule ratios are generally higher than those of the other two subfamilies of the *Leguminosae*, probably due to the pollen dispersal unit, the polyad. The polyads increase the genetic relatedness of the pollen grains arriving at the stigma so that selective screening of paternal genotypes is more likely among than within fruits. The fruit:flower ratios of the *Mimosaceae* examined are much lower than those of the other two subfamilies. For reviews of seed abortion within fruits see Bawa & Buckley (l.c.) and on the floral ecology of Australian *Acacia* see Bernhardt (1989). As pointed out by Kenrick & Knox (l.c.: 151), the knowledge of pollen–pistil interactions is restricted to one large genus, *Acacia*. In this genus the flower



glomerules are protogynous. This dichogamy stimulates outbreeding and is associated with various devices to attract pollinators, including scent production from osmophores in the anther walls at the male phase, floral nectaries and anther glands. A remarkable feature of *Acacia* is the apparent correlation between the number of grains in the polyad and the ovule number per ovary. This mechanism profoundly affects fecundity because of the rigid control of polyad output per anther. Many species of the *Mimosaceae* are self-incompatible and in *Acacia* genetic experiments suggest that this is controlled by a gametophytic S-gene system. Self-incompatibility has been recorded from a few species of the genera *Calliandra*, *Enterolobium*, *Inga*, *Leucaena*, *Pentaclethra*, *Pithecellobium*, *Prosopis* and *Samanea* (Kenrick & Knox l.c.). Personal observations on *Adenanthera pavonina* grown in greenhouses show that this species is self-compatible and that pollination can be effected by shaking the tree. Unisexual flowers are found in *Archidendron* (Nielsen et al. 1984), where dioecy is frequent in New Guinea species.

*Pollinators.* Probably most species are bee- and/or butterfly-pollinated, e.g. almost all species of *Acacia*, *Albizia*, *Calliandra*, and *Mimosa*. The genus *Parkia* is bat-pollinated (p. 195). Ornithophily has been recorded from some New World *Mimosaceae* (*Abarema*, *Albizia*, *Calliandra*, *Inga*, *Samanea*) and from *Acacia nilotica* in India (Arroyo 1981) and Africa.

*Ant-plant interactions.* The extrafloral nectaries of leaf rachises, petioles and pinnae can be observed fully developed on leaf primordia of all Malesian *Mimosaceae* except *Adenanthera*, *Entada* and *Mimosa*. They seem to function in young and developing leaves only and are visited by ants. McKey (1989) gave an account on interactions between ants and leguminous plants. Extrafloral nectaries have been recorded from all tribes except tribe *Mimozyantheae* (in Argentina). In tribe *Parkieae* they are found in both genera, in *Mimoseae* they are absent from 12 out of 37 genera, in *Acacieae* they are absent from a few species of *Acacia* subg. *Phyllodineae* and from sect. *Filicineae*, and in *Ingeae* they are present in all genera. Ants feed on the nectaries and in at least some cases protect the plant against herbivores. In Sabah the author (ICN) observed aggressive red tailor-ants on *Archidendron ellipticum*. Ants also inhabit the hollow leaf rachis and stems of several *Archidendron* species in New Guinea.

*Dispersal.* The dispersal unit of the *Mimosaceae* is either the whole pod, as in species with indehiscent pods of *Acacia*, *Albizia*, *Enterolobium*, *Samanea*, *Serianthes* and *Schleinitzia*, or 1-seeded segments of the pod as in *Cathormion*, *Entada*, *Mimosa*, *Wallaceodendron*, or the seed in the genera *Adenanthera*, *Dichrostachys*, *Leucaena*, *Neptunia*, *Parkia*, dehiscent species of *Acacia*, *Albizia*, *Archidendron*, *Archidendropsis*, *Pararchidendron*, and *Paraserianthes*. The dispersal agents are water and wind. The 1-seeded segments of *Entada phaseoloides* and *E. rheedii* can be widely dispersed by rivers and sea-currents as are the indehiscent pods of *Serianthes grandiflora*, a species mainly found on off-shore islands and occurring throughout Malesia but not yet known from tropical Australia, unlike *Cathormion umbellatum*, which is found in moist habitats and in associations behind the mangrove from mainland Asia through Malesia to N Australia. The Pacific genus *Schleinitzia* p.p. and *Albizia retusa* have thinner pods and are also sea-dispersed. Wind-dispersal has been recorded for some species of *Acacia* that have samaras. *Albizia pedicellata* also has samaras, and is probably wind-dispersed. Most species of *Archidendrop-*

*sis* have flattened seeds with a narrow wing. They have not yet been observed as wind-dispersed, but probably are (Nielsen et al. 1983; Gunn 1984). In *Wallaceodendron* the one-seeded endocarp segments are adapted to wind-dispersal (Augsburger 1989). The species of *Archidendropsis* and *Wallaceodendron* do not have very wide distributions, whereas *Albizia pedicellata* has a wider area of distribution (Malaya, Sumatra, Borneo, Philippines). The size of landmasses and the distances to be bridged over open sea explain these differences in distribution patterns and wind-dispersal does not seem to be long-distance dispersal in Malesian *Mimosaceae*. Endozoochorous dispersal is frequent in species with indehiscent pods as e.g. *Acacia nilotica*, where one tree can produce more than 30,000 seeds in one fruiting season (Tybirk 1989) and the pods are eaten by cattle and other ruminates, the germination being promoted by the passage through the digestive system. Many seeds in this and other hard-seeded species are destructed by Bruchid weevils, highly host-specific seed predators. Endozoochoric dispersal has also been observed in *Adenanthera pavonina*, where fruit-eating birds feed on the red, hard, mimetic seeds but are unable to break the seed coat and defecate them intact, while granivorous birds refuse them (Van der Pijl 1982). Ornithochory probably also plays an important role in the dispersal of *Archidendron* and *Pararchidendron*, with the bluish-black seeds contrasting with the orange-red endocarp in most species (Nielsen et al. 1984). Ornithochory also is important in species with arillate seeds such as in *Acacia* subg. *Phyllodineae* p.p. and American *Pithecellobium*. Ant dispersal plays a role in Australian and probably also in New Guinea species of *Acacia* with arillate seeds (Van Staden et al. 1989). Small mammals probably disperse large-seeded species such as *Archidendron jiringa* and *Entada spiralis*.

Biologically the genera of *Mimosaceae* can be divided into two groups: those with seeds with a hard seed coat and those with short-lived, 'recalcitrant' seeds. The genera with seeds with a hard seed coat have an outer layer which consists of a palissade layer of Malpighian cells with a 'light line', but often also of one or two layers of 'hour-glass' cells (Corner 1951, 1976; Nielsen et al. 1983; Gunn 1984; Maumont 1990). These seeds also have a pleurogram on the outer surface. The seeds of this group have a very long dormancy, the hard seed coat protecting the embryo against desiccation, physical damage and damage by predators. In at least some cases it acts as a regulator of the size of the seedling populations as the seeds only germinate in case of scarification of the seed coat after, for instance, the passage through the guts of cattle or the extreme heat caused by forest fires (e.g. *Acacia* p.p. and *Paraserianthes lophantha* in Australia and Java; Cavanagh 1980; Van Steenis 1972). Seeds with hard seed coats are found in the tribes *Acacieae*, *Ingeae* p.p., *Mimoseae*, *Mimozyantheae*, and *Parkieae*. In Malesia the following genera of tribe *Ingeae* have a hard seed coat with pleurogram: *Albizia*, *Cathormion*, *Pararchidendron*, *Paraserianthes*, *Samanea*, *Serianthes*, and *Wallaceodendron*.

In the Malesian genera *Archidendron* and *Archidendropsis* very short-lived, so-called recalcitrant seeds are found. These seeds are so short-lived that they sometimes germinate in the pod (some species of Malesian *Archidendron* and New Caledonian *Archidendropsis*). The seeds of these two genera and also of the American genera *Cojoba* and *Zygia* are often 'overgrown', as termed by Corner, and have large amounts of nutrition securing the developing seedling in everwet habitats for a long period.

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**Taxonomy** — Most of the fundamental work by G. Bentham (1875) is still valid, at tribal as well as at generic and specific level. He recognized "... 7 tribes or collective genera, and 46 genera or subgenera" (l.c.: 343). Tribes 1. *Pentaclethra* and 2. *Parkia* were defined by the imbricate sepals, a character pointing towards a relationship with the caesalpinoid genus *Dimorphandra* and its allies (e.g. the Malesian genus *Sympetalandra*). Hutchinson (1964) and Elias (1981) considered them as belonging to one tribe named *Parkieae* and also accepted the tribe *Mimozgyantheae*, based on the Argentinian monotypic genus *Mimozgyanthus*, which has imbricate and free sepals. In Bentham (l.c.) the three following tribes, 3. *Piptadenieae*, 4. *Adenanthereae* and 5. *Mimoseae*, have valvate sepals and a definite number of stamens. In the *Piptadenieae* the seeds have no albumen, but the anthers have a stipitate gland at the apex of the connective as in most of the *Adenanthereae*, which have albuminous seeds. Tribe 5. *Mimoseae* has anthers usually without glands and albuminous seeds. Hutchinson (1964) united the *Piptadenieae* and *Adenanthereae* as the distinction between them broke down after the study of new material. Finally Lewis & Elias (1981) united all the species with valvate sepals and a definite ( $\leq 10$ ) number of free stamens into one tribe: the *Mimoseae*. The fruit and seed characters play an important role in tribe *Mimoseae* where 38 genera with more than 720 species are now recognized and in which the American/African/Indian genus *Mimosa* accounts for some 350–400 species.

In tribe *Acacieae*, which has been kept since Bentham (l.c.), the stamens are free, only exceptionally connate at the base (the African *Faidherbia albida*) (see also Vassal 1981). Two of the subgenera, *Acacia* and *Aculeiferum*, have many species with anther glands similar to the ones found in many *Mimoseae*. The glands are lacking in the third subgenus, *Phyllodineae*, and in the American section *Filicinae* of subgenus *Aculeiferum*. The species of section *Filicinae*, moreover, lack extrafloral nectaries on the leaves, they are unarmed,



and the floral pedicel is jointed (as in *Adenanthera*) and will probably prove to belong to a distinct subgenus of *Acacia*. Recently Pedley (1986) proposed to divide the classical genus *Acacia* into three genera: *Acacia* (= *Acacia* series *Gummiferae* Benth.), *Racosperma* Mart. (*Acacia* series *Phyllodineae* Benth.) and *Senegalia* Raf. (*Acacia* series *Vulgares* Benth.). However, the characters presented by Pedley give evidence for a division into two genera, *Acacia* and another combining *Racosperma* and *Senegalia*, and until the American species have been compared with the Australian species, it seems better to keep the large genus *Acacia* with more than 1300 species intact. Moreover, the three genera proposed seem to be closer related to each other than to the rest of the *Mimosoideae*, and the discussion is then a question of rank. Species as *Acacia harmandiana* of Indochina and Thailand with 15–22 stamens and *A. leucophloea* with 20–25 stamens and glandular anthers could belong to the oldest part of subgenus *Acacia*, showing convergence in characters to those of the *Mimoseae*. The number of *Acacia* species is low in Malesia as compared to Australia, and the disjunct distributional areas of some members of subg. *Aculeiferum* (Nielsen 1985) and *Acacia* (*A. tomentosa* and *A. leucophloea*) of mainland Asia and those of species of subgenus *Phyllodineae* common to New Guinea and Australia clearly show that the Malesian *Acacia* flora is of dual origin: W Malesia/mainland Asia and New Guinea/Australia, the two elements meeting in the Lesser Sunda Islands.

In tribe *Ingeae*, defined by the indefinite number of stamens which are fused to a tube at the base, Bentham recognized “15 genera or subgenera” (l.c.: 343) with 408 species. At present some 20 genera and c. 1000 mostly tropical species are recognized (Nielsen 1981). Unlike *Acacia*, which has spread into the semiarid regions of the tropics and which there plays an important phytosociological role, the major part of the *Ingeae* is found in the humid part of the tropics, although a few genera (e.g. *Albizia*) extend into semiarid and warm temperate regions as well and have developed deciduous species.

*References:* Bentham, G., Trans. Linn. Soc. 30 (1875) 335–668. — Elias, T.S., in R.M. Polhill & P.H. Raven (eds.), *Advances in Legume Systematics* 1, Roy. Bot. Gard. Kew (1981) 183. — Hutchinson, J., *The Genera of Flowering Plants* 1, Dicotyledons (1964) 277–297. — Lewis, G.P. & T.S. Elias, in Polhill & Raven (eds.), l.c. (1981) 155–168. — Nielsen, I., in Polhill & Raven (eds.), l.c. (1981) 173–190; *Opera Bot.* 81 (1985) 7–26. — Pedley, L., *Bot. J. Linn. Soc.* 92 (1986) 219–254. — Vassal, J., in Polhill & Raven (eds.), l.c. (1981) 169–171.

**Fossils** — Recent treatments on leaf impressions of *Albizia* and *Archidendron* from the late Miocene of China by Guo Shuang-Xing & Zhou Zhe-Kun (1992), on fossil wood of *Albizia* from the Neogene of India by Awasti (1992), and on leaves and fruits of *Acacia*, *Albizia* and *Serianthes* from the Miocene of New Zealand by Pole (1992) give an idea of the former distribution of the *Mimosaceae*.

*References:* Awasti, in P.S. Herendeen & D.L. Dilcher (eds.), *Advances in Legume Systematics* 4, The fossil record, Roy. Bot. Gard. Kew (1992) 225–250. — Guo Shuang-Xing & Zhe-Kun Zhou, in Herendeen & Dilcher (eds.), l.c. (1992) 207–223. — Pole, in Herendeen & Dilcher (eds.), l.c. (1992) 251–258.

**Uses** — Several exotic species of the *Mimosaceae* have been introduced as ornamentals and/or shade-trees, cover-crops, sources of firewood etc. The introduced species are of either Australian (*Acacia*) or American (*Acacia*, *Albizia*, *Calliandra*, *Inga*, *Leucaena*,

*Mimosa*, *Pithecellobium*, *Prosopis*) origin. The well-established naturalized species have been included in this treatment, the most common, non-naturalized ones have been included in the keys only with a note on the geographical origin (see also Backer & Bakhuizen f. 1963, for keys and short descriptions of the introduced species). Seeds and pods of *Archidendron bubalinum*, *A. jiringa* and *Parkia speciosa* are very often seen in town markets of W Malesia, as are the floating stems of *Neptunia oleracea* that are used as a vegetable. The fast-growing *Leucaena leucocephala* (National Academy of Sciences 1979), a native of tropical America, is used in reafforestation projects. One of the fastest growing trees of the tropics, *Paraserianthes falcataria*, originates from E Malesia and is an important source for paper pulp. It is very often planted as a shade-tree as well, although the roots grow superficially and spread widely, and the tree starts to decay at a rather young age (c. 10 years) dropping the branches on the crop it covers, causing considerable damage. The species of *Mimosa*, originally imported as cover-crops to prevent erosion, have now become serious weeds and thus of adverse economic importance.

Important timber trees are *Albizia acle* of the Philippines and *Acacia mangium* of East Malesia/Australia. The latter species is now widely used in reafforestation projects. Some of the *Albizia* species of the everwet areas of W Malesia (e.g. *A. pedicellata*, *A. rosulata*, *A. splendens*) deserve wider recognition. The saponin contents of the wood and bark of *Albizia acle* and *A. saponaria* is high. The latter has been used as soap and as fish poison (Burkill 1966).

Amongst the ornamentals the South American *Samanea saman*, the 'Rain Tree', is the most widespread and, together with the Madagascan *Delonix regia*, the 'Flame of the Forest' (*Caesalpinaceae*), the most common street tree in Malesia. *Acacia auriculiformis* of New Guinea/Australia is also widespread, especially in regions with a seasonal climate.

For further information about uses, consult Heyne (1927), Corner (1940), and Burkill (1966), and the notes under genera and species.

*References:* Backer, C.A. & R.C. Bakhuizen van den Brink f., *Flora of Java* 1 (1963) 547–565. — Burkill, I.H., *A dictionary of the economic products of the Malay Peninsula*, ed. 2 (1966). — Corner, E.J.H., *Wayside trees of Malaya* (1940). — Heyne, H., *De nuttige planten van Nederlands Indië*, ed. 2 (1927); National Academy of Sciences, *Tropical legumes: Resources of the future*, Washington, D.C. (1979) 1–328.

*Cytology* — Goldblatt (1981) reviewed the basic chromosome numbers of the *Mimosaceae*;  $x = 14$  and  $x = 13$  are the widespread numbers. Tetraploids and/or octaploids have been recorded in the genera *Schleinitzia*,  $x = 27, 26$ ; *Dichrostachys* and *Acacia* subg. *Acacia*. (*A. farnesiana*,  $2n = 52, 104$ ; *A. leucophloea*,  $2n = 52$ ), *Adenanthera pavonina* (26, 64?), *Mimosa pudica* (32, 48, 52), *Neptunia oleracea* (52, 54) (see also Nielsen 1981). Several counts need confirmation. During my recent study for *Archidendron grandiflorum*  $2n = 26$  was counted (no 89 BI 00472, ex Australia, AAU).

*References:* Goldblatt, P., in R.M. Polhill & P.H. Raven (eds.), *Advances in Legume Systematics* 2, Roy. Bot. Gard. Kew (1981) 434–436. — Nielsen, I., *Fl. Camb. Laos Vietnam* 19 (1981) 6.

*Fruits and Seeds* — Gunn (1984) made a comprehensive survey of the *Mimosaceae*. In this work keys to the genera, illustrations and descriptions make it possible to identify fruits and seeds to genus. The pistil mostly consists of a single carpel (2–15 free carpels

are found in some species of *Affonsea*, *Archidendron*, *Inga*, *Serianthes*, *Zygia*) and develop into a pod of very varying dimensions from less than 1 cm to over 100 cm long (*Entada* p.p.). As noted in the paragraph on Habitat and Ecology form, texture and dehiscence of the fruits reflect co-adaptations with the dispersal agents. Epi-, meso- and endocarp vary in sheen, colour, texture and the endocarp may be septate, forming one-seeded chambers. The funicle varies in length, thickness and shape and may in some species of *Acacia* and *Pithecellobium* develop into an aril. The pod characters seem to be rather variable and e.g. dehiscent and indehiscent pods can be found in otherwise closely related species. Thus caution should be taken when using them as generic characters, though some distinct apomorphies exist, such as the one-seeded winged endocarp segments of *Wallacedendron* and the woody boomerang-shaped pods of *Xylia*. As can be seen in Gunn (l.c.), it is not possible to key out the three families of *Leguminosae* on fruit characters alone.

An outstanding seed character distinguishing the *Mimosaceae* from all *Fabaceae* and the major part of the *Caesalpiniaceae* is the pleurogram, a U-shaped or horseshoe-shaped single or double line found on both faces of the seed and sometimes continuous between them. The pleurogram is a fissure in the epidermal palissade layer (= Malpighian cells) and it is constant to such an extent that it is possible to identify specimens of e.g. *Albizia* to species according to its form and size. As noted by Gunn (l.c.) pleurograms are present in 31 genera, absent or present in 8 genera and absent in 25 genera. In tribes *Acacieae* and *Ingeae* the occurrence of the pleurogram is associated with the development of a thick seed coat (= exotesta sensu Corner 1976). Maumont (1990) wrote a thesis on the taxonomic importance of the anatomical structure of the seed coat in the two tribes. The seed coat of the pleurogrammatic seeds have thick-walled Malpighian cells with a 'light line' and often also 'hour-glass' cells ('cellules en sablier' sensu Maumont) and cells that support the fissure line are present. In genera without pleurogram (e.g. *Archidendron*, *Archidendropsis*) the Malpighian cells are thin-walled, low and without light line, hour-glass cells or cells supporting the fissure line. In tribe *Mimoseae* this association of characters is not always present, e.g. *Entada phaseoloides* and *E. rheedii* and a major part of other *Entada* species have osseous to coriaceous seed coats without pleurogram, whereas the wind-dispersed *Entada abyssinica* from E Africa has a pleurogram. As shown by Nielsen et al. (1983) and Maumont (l.c.), the characters of the seed coat support those of the vegetative parts, the flowers and pollen, and are very useful in the generic delimitation in the tribes *Acacieae* and *Ingeae*. According to Corner (1951) and Maumont (l.c.) the 'overgrown' seeds (i.e., seeds without pleurogram and with an unspecialized testa) are adapted to humid environments and they have been shown to be 'recalcitrant' (without dormancy). It is difficult to explain the significance of the hard seed coat of the *Albizia* species found in tropical lowland rain forest (e.g. *A. dolichadena*, *A. rosulata*, and *A. splendens*) except as an extremely efficient protection against predators or as just a relict character, also present in the related species *Albizia attopuensis* of the Thai-Laotian savannas.

*References:* Corner, E.J.H., *Phytomorphology* 1 (1951) 117–150; *The seeds of the dicotyledons* 1 & 2 (1976). — Gunn, C.R., U.S. Dept. Agric. Techn. Bull. 1681 (1984) 194. — Maumont, S., *Intérêt taxonomique de l'histologie des téguments séminaux chez les Acacieae et les Ingeae (Leguminosae-Mimosoideae)*, Thesis Univ. Sabatier, Toulouse (1990) 1–184. — Nielsen, I., Ph. Guinet & T. Baretta-Kuipers, *Bull. Mus. Natn. Hist. Nat. Paris, sér. 4, 5, sect. B, Adansonia* no 3 (1983) 303–329.



Seedlings — De Vogel (1980) classified the seedlings in 16 types. His seedling type 2a, the *Sloanea* subtype “characterised by an elongated, epigeal hypocotyl and with the cotyledons borne above soil level” is the most widespread in the subfamily and has been recorded for the Malesian genera *Acacia*, *Adenanthera*, *Albizia*, *Paraserianthes*, *Parkia*, and *Serianthes* (Burger Hzn 1972; Nielsen et al. 1983; De Vogel, l.c.). The *Macaranga* type has been found in *Entada*. The *Endertia* type, *Chisocheton* subtype has been observed in *Archidendron ellipticum* and *A. jiringa* (Fig. 7). The best studied genus is *Acacia*, where a series of subtypes useful in the infrageneric classification have been established (Vassal 1969, 1972).

Léonard (1957), Duke (1965), Ng (1975), and Duke & Polhill (1981) advocated a more simple approach distinguishing between 6 different types of seedlings in *Leguminosae*. According to this classification, the Malesian genera of *Mimosoideae* belong to the following three types: phaneroepigeal in *Acacia*, *Adenanthera*, *Albizia*, *Archidendropsis* (New Caledonia), *Dichrostachys*, *Mimosa*, *Paraserianthes*, *Parkia*, *Samanea*, and *Serianthes*; phanerogeal in *Archidendropsis paivana* (New Caledonia); phanerohypogeal in *Archidendron* (3 species known). For general remarks on the ecology of the seedlings see Duke & Polhill (l.c.). The types reflect adaptations to habitats, the phaneroepigeal seedling being adapted to ‘open’ habitats such as deciduous forest and savanna; the phanerogeal and phanerohypogeal seeds are more adapted to humid habitats such as rain forest.

Within the tribes interesting differences in phyllotaxis can be observed. Guinet & Rico (1988) showed that leaf-structure progression patterns can be observed in the American *Ingeae*. The Malesian genera do not quite fit into these patterns. In *Albizia*, *Archidendropsis*, and *Paraserianthes lophantha* the first leaf is pinnate and the second bipinnate, unijugate. In *Archidendron*, *Paraserianthes falcataria* and *Serianthes* the first leaf is bipinnate. In *Serianthes sachetae* (New Caledonia) the first two leaves are opposite. *Archidendron ellipticum* and *A. jiringa* have alternate first leaves. In *Archidendron grandiflorum* of ser. *Archidendron* the seedling pinnae are unifoliate, a feature shared with the mature leaves of ser. *Morolobiae* and thus pointing towards an affinity between these two series, both centred in the E Malesian–NE Australian area (see also Nielsen et al., 1983).

*References:* Burger Hzn, B., Seedlings of some tropical trees and shrubs mainly of S.E. Asia, Pudoc, Wageningen (1972) 156–196. — Duke, J.A., Ann. Missouri Bot. Gard. 52 (1965) 314–350. — Guinet, Ph. & L.A. Rico, Pollen et Spores 30 (1988) 313–328. — Guinet, Ph., J. Vassal, C.S. Evans & B.R. Maslin, Bot. J. Linn. Soc. 80 (1980) 53–68. — Léonard, J., Mém. Acad. Roy. Belg. Cl. Sc. 30 (2) (1957) 1–312. — Ng, F.S.P., Malay. For. 38 (1975) 33–39. — Nielsen, I., Ph. Guinet & T. Baretta-Kuipers, Bull. Mus. Natn. Hist. Nat. Paris, sér. 4, 5, sect. B, Adansonia no 3 (1983) 303–329. — Vassal, J., Bull. Soc. Hist. Nat. Toulouse 105 (1969) 55–111; *ibid* 108 (1972) 125–247. — Vogel, E.F. de, Seedlings of Dicotyledons, Pudoc, Wageningen (1980) 84–85, 304–336.

**Vegetative Anatomy** — The following is summarized from Metcalfe & Chalk’s (1950) general survey of the anatomy of the *Mimosaceae*, extended by data from more recent publications cited below. The anatomical diversity of the Malesian representatives is only incompletely known and further study will certainly provide markers of taxonomic interest.

*Leaf anatomy.* The indumentum, when present, is very diverse and composed of non-glandular, unicellular or uniseriate, or multiseriate unbranched or branched hairs (in *Mi-*

*mosa*). Glandular hairs of the following types may occur: unicellular or multicellular, ellipsoid or clavate head on uniseriate stalks or sessile in e.g. species of *Acacia*, *Adenanthera*, *Albizia*, *Entada*, *Leucaena*, *Mimosa*, *Neptunia*, and *Serianthes*; peltate to stellate glands in *Acacia* p.p. and *Mimosa* p.p.; glandular shaggy hairs with multi- or uniseriate stalks in *Mimosa* p.p. The epidermis is papillate in a number of species and genera. Epidermal cells with inner mucilage walls occur in species of *Acacia*, *Adenanthera*, *Albizia*, *Dichrostachys*, *Entada*, *Leucaena*, *Mimosa*, *Neptunia*, *Parkia*, and *Serianthes*. Stomata are either confined to the lower leaf surface, or occur on both leaf surfaces in e.g. *Acacia*, *Dichrostachys*, *Mimosa*, and *Neptunia*. Stomata usually paracytic, but subsidiary cells sometimes secondarily subdivided in *Acacia*; in phyllodes of some *Acacia* species stomata predominantly cyclocytic, more rarely anisocytic or anomocytic. Mesophyll ranging from dorsiventral to centric. Vascular bundles of the smaller veins usually embedded in the mesophyll. Petiole often with a complex vascular system. For a review of structure and function of pulvini in nycto- or seismonastic species see Wilkinson (1983). Crystals usually rhomboidal, more rarely clustered (e.g. in *Mimosa*). Secretory cells with colourless or yellowish contents observed in a number of species. Secretory sacs recorded in Neotropical species of *Pithecellobium* but possibly occurring elsewhere as well. Extrafloral nectaries composed of parenchyma tissue surrounded by crystalliferous cells are of general occurrence, e.g., in species of *Acacia*, *Albizia*, *Dichrostachys*, and *Samanea*.

*Wood anatomy.* Vessels diffuse, sometimes in a weakly pronounced oblique pattern, typically medium-sized (100–200 µm), solitary and in short radial multiples. Vessel perforations simple. Intervessel pits alternate, vested. Vessel-ray pits similar but half-bordered. Solid vessel contents usually present. Fibres with few, small pits largely confined to the radial walls, septate in *Albizia* p.p., *Cathormion*, and *Leucaena*. Parenchyma usually abundant and predominantly paratracheal vasicentric, aliform, confluent or banded: mostly vasicentric in *Acacia* p.p., *Albizia*, *Dichrostachys*, and *Paraserianthes*; mostly confluent in *Acacia* p.p., *Adenanthera* p.p., and *Parkia*; in broad bands in *Archidendron* and *Entada*; in irregular zonate bands (in addition to paratracheal parenchyma) in some species of *Acacia* and *Albizia*. Diffuse parenchyma (additional to the paratracheal parenchyma), often crystalliferous, fairly common in *Acacia* p.p., *Adenanthera*, *Albizia* p.p., *Cathormion*, *Dichrostachys*, *Leucaena*, *Paraserianthes*, *Parkia*, *Serianthes*, and *Wallaceodendron*. Strands usually of 2–4 cells, parenchyma more rarely fusiform. Rays mostly biseriate or wider; (almost) exclusively uniseriate in *Acacia* p.p., *Albizia* p.p., *Archidendron*, *Paraserianthes*, and *Wallaceodendron*; homocellular, composed of procumbent cells only. Storied structure sometimes present, but never distinct in rays and fusiform elements at the same time. Crystals prismatic, usually present in chambered axial parenchyma, typically in long chains, rarely in ray cells.

The *Mimosaceae* are wood anatomically the most distinctive of the *Leguminosae*, although some overlap with the, wood anatomically intergrading, *Papilionaceae* and *Caesalpiniaceae* exists.

*References:* Baretta-Kuipers, T., IAWA Bulletin 1979/2 & 3 (1979) 47–50 (*Archidendron*, wood anatomy); Wood anatomy of Leguminosae: its relevance to taxonomy, in R.M. Polhill & P.H. Raven (eds.), *Advances in Legume Systematics* 2, Roy. Bot. Gard. Kew (1981) 677–705. — Boughton, V.H., *Austral. J. Bot.* 37 (1989) 157–168 (trichomes, *Acacia*). — Burgess, P.F., *Timbers of Sabah* (1966)

343–385. — Fundter, J.M. & J.H. Wisse, Meded. Landbouwhogeschool Wageningen 77-9 (1977) 1–223 (wood anatomy of New Guinea *Adenanthera*). — Ilıc, J., CSIRO Atlas of Hardwoods (1991) 252–291. — Leelavathi, P., N. Ramayya & M. Prabhakar, Phytomorphology 30 (1980) 195–204 (leaf anatomy). — Lomibao, B.A., Araneta Res. J. 24 (1977) 11–32 (Moluccan woods). — Martaijaya, A., I. Kartasujana, Y.I. Madang, S.A. Prawira & K. Kadir, Atlas Kayu Indonesia II (1989) 59–64 (wood of *Paraserianthes*). — Maruzzo, M.M. & W.M. America, Forpride Digest 10 (1981) 16–27 (*Leucaena* wood anatomy). — Meniado, J.A., R.R. Valbuena & F.N. Tamolang, Timbers of the Philippines 1 (1974). — Metcalfe, C.R. & L. Chalk, Anatomy of the Dicotyledons 1 (1950) 476–487. — Nielsen, I. & Ph. Guinet, Nordic J. Bot. 12 (1992) 85–114 (leaf anatomy *Adenanthera*). — Quirk, J.T., IAWA Bull. n.s. 4 (1983) 118–130 (wood anatomy and identification). — Schnell, R., G. Cusset & M. Quenum, Rev. Gén. Bot. 70 (1963) 269–342 (extrafloral nectaries). — Shah, G.L., M.H. Parabia & M.J. Kothari, Ann. Bot. 36 (1972) 823–835 (leaf anatomy). — Solereder, H., Systematische Anatomie der Dikotyledonen & Ergänzungsband (1899 & 1908). — Sudo, S., Bull. For. & For. Prod. Res. Inst. 350 (1988) 1–199 (Papua New Guinea timbers). — Wheeler, E.A. & P. Baas, in P. S. Herendeen & D.L. Dilcher (eds.), Advances in Legume Systematics 4, Roy. Bot. Gard. Kew (1992) 281–301 (fossil woods). — Wilkinson, H.P., Notes Jodrell Lab. 10 (1983) 1–21 (leaf anatomy). — Wu, Hsieh & Wang, Q. J. Exp. For. Natn. Taiwan Univ. 2-2 (1991) 27–43 (wood, *Acacia mangium*).

P. Baas

Palynology (see also *Acacia*) — Pollen morphology of the subfamily *Mimosaceae* is extremely diverse (Guinet 1969, 1981, 1990; Guinet & Ferguson 1989). The basic pollen type common to all 3 subfamilies of the *Leguminosae* includes single, isopolar,  $\pm$  spheroidal, small-sized ( $P = 20\text{--}35\ \mu\text{m}$ ), 3-colporate grains with a semitectate exine, a columellate infratectal layer, and a well-developed foot layer and endexine (Guinet 1981). Pollen grains of *Fabaceae* are always single. Tetrads occur rarely in the *Caesalpiniaceae*, and more frequently in the *Mimosaceae*, though mostly as an occasional variant together with single grains or polyads in the same anther. Polyads are restricted to the *Mimosaceae*. Within the angiosperms, polyads are known in a few other families (Knox & McConchie 1986), but there they show much less internal organisation. Polyads arise through one or several mitotic divisions of the sporogenous cells prior to meiosis. In the *Mimosaceae* they usually contain 8, 16 or 32 grains (monads); deviating numbers, always quadruples, were found in a few genera. Polyad size is up to c.  $350\ \mu\text{m}$ . Shape may be symmetric or asymmetric, and the monads may be more or less independent or variously connected by exine bridges. In the extreme case the monads have a much reduced proximal exine and fused distal tectum part (calymate polyad).

Guinet (1981) listed the frequencies of single and compound grains (tetrads + polyads) in the genera of the *Mimosaceae* (c. 1700 species studied). In the tribe *Parkieae* the grains are single (*Pentaclethra*) or compound (*Parkia*). The *Mimoseae* also have single and compound grains. Several genera (e.g. *Entada*, *Dichrostachys*, *Leucaena*) show both types. The genera that exclusively have single grains are rare in tropical regions in Asia, Australia and the Pacific (only *Indopiptadenia* and a few *Neptunia* species). The tribes *Acacieae* and *Ingeae* always have polyads that show weak to strong heteromorphy, i.e. difference between the peripheral and central monads as to size, apertures, exine structure and thickness, and/or ornamentation.

Single grains have a 3-colporate apertural system, sometimes with 2 pores inside each colpus or with fused colpi (syncolpate: *Desmanthus*, *Leucaena*, *Neptunia*, *Prosopis*). Monads of tetrads are 3-colporate or 3-porate. The latter type also occurs in 8- and 12-



celled polyads. Monads of more-celled polyads generally have 4–12 pores, which are located distally, near the exposed surface, and often also proximally, on the internal (obscured) surface of each monad. All pores are functional. Pores of adjacent monads face each other in clusters of 2, 3 or 4. Monads with a proximally reduced exine may have pores at the proximal side and colporate apertures at the distal side (e.g. *Acacia* subg. *Acacia*). With a few exceptions *Mimoseae* polyads only show pores at the distal side in clusters of 2 or 3, and *Acacieae* and *Ingeae* polyads pores at either side in clusters of 3 and/or 4. *Parkia* has very small pores in clusters of 2 or 3, located only at the distal side. Most genera of the *Mimosaceae* have pores with an annulus-like thinning and/or ligulae, which are features that do not occur in the other subfamilies. Circular or square colpus-like thinnings of the ectexine without pores and, by consequence, without a germinative function (pseudocolpi) are found in several *Mimoseae* genera and many *Acacia* species; probably they have a harmomegathic function (Guinet 1986). Calymate polyads behave as single harmomegathic units.

Mimosaceous pollen usually has a well-developed tectum, foot layer and endexine. The infratectal layer may be columellar or granular. A columellar infratectum is particularly frequent in taxa with single grains, and a granular infratectum in taxa with polyads. Several genera, and even species show both types.

Ornamentation is less variable than in the other subfamilies. The commonest type is areolate, with polygonal or sinuous areoles (flat or sometimes bulging tectum parts separated by narrow grooves) in the *Ingeae*, and smaller, rounded ones in other tribes. Areoles with lumina occur in *Parkia*. Other ornamental types found are verrucate, reticulate, striate-reticulate, rugulate-reticulate and smooth. The tectum is crossed by a variable number of mostly narrow perforations. In polyads the proximal sides of the monads generally have a reduced exine.

The fossil record as presently known (Guinet & Ferguson 1989) indicates evolution from single grains to tetrads and to polyads. The change towards compound grains, the predominant differentiation of these forms, and the simultaneous change from a columellar towards a granular infratectum appear to have happened during the Eocene. Several records of Cretaceous tetrads and 8-celled polyads attributed to the *Mimosaceae* need verification (Muller 1981). The Oligocene is marked by an important radiation of the taxa with a granular infratectum and the associated porate apertures.

The high degree of heteromorphy in the polyads of some *Mimosaceae* reflects the strong interrelationship with specialized pollinators. High polyad asymmetry is associated with the occurrence of a mucilage coating on the top of a single specialized monad in some *Calliandra* species, or with dark coloured polyads (*Parkia*, *Serianthes*). Then, polyad size is remarkably large too (150–350  $\mu\text{m}$ ). This suite of characters probably indicates the transference of the attractive role from individual flowers to pollen (Guinet & Ferguson 1989).

*References:* Guinet, Ph., Trav. Sec. Sci. Tech. Inst. Fr. Pondichéry 9 (1969) 1–293; in R.M. Polhill & P.H. Raven (eds.), *Advances in Legume Systematics* part 2, Roy. Bot. Gard. Kew (1981) 789–799, 835–857; Linn. Soc. Symp. Ser. 12 (1986) 297–311; Pl. Syst. Evol. Suppl. 5 (1990) 81–90. — Guinet, Ph. & I.K. Ferguson, in C.H. Stirton & J.L. Zarucchi, *Advances in Legume Biology*, Monogr. Syst. Bot. Missouri Bot. Gard. 29 (1989) 77–103. — Knox, R.B. & C.A. McConchie, Linn. Soc. Symp. Ser. 12 (1986) 265–282. — Muller, J., Bot. Review 47 (1981) 1–142.

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**Phytochemistry & Chemotaxonomy — General remarks:** During the past 40 years three more or less comprehensive phytochemical and chemotaxonomic reviews of the whole family, i.e. *Leguminosae* (= *Fabaceae* s.l.) with *Caesalpinioideae*, *Mimosoideae* and *Papilionoideae*, or, if treated as an order, *Leguminales* with *Caesalpiniaceae*, *Mimosaceae* and *Papilionaceae* (= *Fabaceae* s.str.), were published (Hegnauer 1956; Harborne et al. 1971; Polhill & Raven 1981), and volume XI of 'Chemotaxonomie der Pflanzen' will cover ethnobotany, chemical ecology and most exhaustively phytochemistry and chemotaxonomy of *Leguminosae* (Hegnauer, in prep.). For the present purpose metabolites of *Mimosoideae* are arranged in the same way as in the last-mentioned treatise. To my knowledge only the pattern of nonprotein (= non-proteinogenic) amino acids in seeds is known from *Mimozyanthus carinatus*, forming the monotypic tribe *Mimozyantheae*; dichrostachinic, djenkolic, N-acetyldjenkolic and 4-hydroxipecolic acid are stored (Krauss & Reinbothe 1973); in this respect the taxon resembles *Parkia* p.p. The other four tribes of the subfamily were explored more or less exhaustively by phytochemists and chemotaxonomists. Therefore the statement that mimosoids share many chemical characters with caesalpinoids and papilionoids is by no means premature. However, frequencies with which individual classes of compounds occur in the three legume subfamilies vary widely. Storage products of seeds, inositols (= cyclitols), non-volatile organic acids, mucilages of vegetative parts and several classes of characteristic secondary metabolites will be mentioned and discussed briefly in this minisurvey. Moreover, a number of toxic constituents of restricted occurrence in mimosoids will not be forgotten, and finally attention will be paid to three ecophysiological characters, phytoalexins, nyctinastins, and nodulation which is connected with nitrogen-fixation, a feature conferring many legumes properties of great promise for future agriculture and for soil amelioration and conservation.

**Storage products of seeds:** Starch is rather seldom stored in ripe seeds of *Mimosoideae* (present, e.g., in *Mimoseae* p.p., *Acacia* p.p. and *Ingeae* p.p.) and *Caesalpinioideae* (e.g. in *Detarieae* and *Amherstieae* p.p.), but occurs in large amounts in many papilionaceous taxa belonging to *Swartzieae*, *Phaseoleae* and *Vicieae* ('Chemical analyses of seeds' 1962–1974; Kooiman 1963; Maheshwari & Chakrabarti 1967); in vegetative parts starch storage seems to be more or less ubiquitous in legumes (Czaja 1978, 1980). Starchless seeds of legumes store mainly protein bodies (aleurone grains), fatty oils (triglycerides) and/or heteropolysaccharides (the so-called reserve celluloses) which are deposited during seed maturation in the cell walls of cotyledonary or (if present) endospermous tissue. Variable amounts of soluble sugars (sucrose, raffinose, stachyose and sometimes verbascose) and of inositols (cyclitols) are present in seeds of all *Leguminosae* (Amuti & Pollard 1977; Yasui & Ohashi 1990). Storage of sucrose oligogalactosides of the raffinose-stachyose series in seeds, but not in vegetative parts, is a character of the whole family (Hegnauer 1956, 1957), though some exceptions are known (Yasui & Ohashi 1990). Most legume seeds also contain the cyclitol monomethyl ether (+)-pinitol, but the latter may be replaced in some taxa by (+)-ononitol, (-)-bornesitol, D-*chiro*-inositol or O-methyl-scylo-inositol (Yashui & Ohashi 1990). Approximately 60–70% of *Leguminosae* produce mature seeds with more than trace amounts (i.e. not only surviving during seed maturation as aleurone layer or around the radicle of the embryo) of endosperm. Legume endosperms are mucilaginous and consist of thick-walled cells with carob or guar gum-type galactomannans;

such reserve celluloses represent a character occurring in all three subfamilies of legumes (Hegnauer 1957); galactomannans of this type have been isolated from seeds of many legumes (Tookey & Jones 1965; Bailey 1971; White et al. 1971; Kooiman 1972), including the following mimosoids: *Desmanthus illinoensis* and *Leucaena glauca* (= *L. leucocephala*) (Dea & Morrison 1975), *Adenanthera pavonina*, *Mimosa multipinna*, *M. pudica*, *Stryphnodendron adstringens*, *S. barbatiman* (= *S. barbadetiman*), *S. obovatum* and *S. polyphyllum* (Buckeridge & Dietrich 1990; Reicher et al. 1991) and *Lagonychium (Prosopis) farctum* (Shcherbukhin 1991). Grubert (1981) listed all legumes known to have a mucilaginous endosperm; his list contains several species of *Acacia*, *Adenanthera*, *Desmanthus*, *Leucaena*, *Mimosa*, *Lysiloma candida* and *Schrankia uncinata*. Mature legume seeds lacking endosperm store their reserves in the cotyledons, whose cell walls are thin or more or less thickened. Amyloid is the usual carbohydrate reserve of thick-walled cotyledons of many representatives of the caesalpinoid tribes *Detarieae* (including *Cynometreae* of Bentham) and *Amherstieae* (Kooiman 1960); amyloid from *Tamarindus indica* was thoroughly investigated by Kooiman (1961); it is composed of glucose, xylose and galactose in the molar ratio 3:2:1; amyloid also occurs in starch-storing, thin-walled cotyledons of a number of *Phaseoleae* (Kooiman 1963), but has, to my knowledge, never been observed in members of *Mimosoideae*. Many legumes with seeds with large cotyledons store besides carbohydrates appreciable amounts of fatty oils and of proteins in the lumina of their cells. Reserve proteins are mainly deposited in so-called protein bodies (formerly aleuron grains) which differ between plant taxa. Lott & Buttrose (1978) and Lott (1981) described shapes and structures of protein bodies of the cotyledons of legumes, mainly of *Papilionoideae*, but also of *Acacia conferta* and of the caesalpinoid *Cassia artemisioides*. Protein bodies consist of a proteinaceous matrix surrounded by a limiting membrane; globoid crystals containing phytin, crystalloids of proteinaceous nature and crystals of calcium oxalate may be included in the amorphous proteinaceous matrix. Protein bodies with globoids of various size and shape and of variable numbers per body, but lacking other crystals, seem to be characteristic of legumes. The proteinaceous matrix of protein bodies may contain one to several main storage proteins (Boulter & Derbyshire 1971; Mossé & Pernollet 1983). At this point it should be remembered that seeds of many *Leguminosae* contain physiologically active proteins, such as protease inhibitors (trypsin and chymotrypsin inhibitors: Liener 1980, 1983; Weder 1981; Norioka et al. 1988), lectins or plant haemagglutinins (Liener 1980, 1983; Toms 1981) and toxalbumins like abrin. Such proteins simultaneously may possess physiological (storage products) and ecological (defence) functions. Moreover, a number of seed proteins is involved in the mobilization of storage products during germination and growth; a typical example concerns urease, an enzyme which may be involved in allantoin, arginine and canavanine metabolism, and which was shown to be present in seeds of most *Leguminosae* tested, including 14 *Mimosoideae* species (Bailey & Boulter 1971). Besides carbohydrates and proteinaceous compounds legume seeds store trace amounts to 45% of lipids. Mean lipid contents were calculated for all *Caesalpinioideae* (6.4%), *Mimosoideae* (8%) and *Papilionoideae* (9.7%) investigated until 1970 (Wolff & Kwolek 1971). It should not be forgotten, however, that comparisons of published results of lipid analyses are often somewhat



ambiguous, because analytical methods differ in accuracy, because kernels alone, whole seeds or even whole indehiscent fruits usually differ in amounts and quality of their lipids (see also later sub *Acacia* arils), and because total lipids of seeds which are often equalized with fatty oils (i.e. triglycerides) are mixtures of nonacyl-lipids and of several acyl-lipid classes, such as the nonpolar triglycerides and waxes s.str. and the much more polar phospho-, glyco- and sulpho-lipids; each lipid class may have its own spectrum of fatty acids. Nevertheless extraction procedures used in oil analyses usually yield lipids which contain triglycerides as main constituents, and some taxonomically interesting tendencies concerning the fatty oil composition of legume seed oils begin to appear in outlines. Most legume seed oils have palmitic (16:0), oleic (18:1) and linoleic (18:2) acids as main fatty acids. In oils of some extratropical *Papilionoideae* linolenic acid (18:3) is present as an additional main fatty acid. Taxon-characteristic features usually concern minor fatty acids in the case of *Leguminosae* seed oils. Hegnauer (1956) believed that fatty oils with relatively large amounts of saturated acids with more than 18 C-atoms, i.e. arachidic (20:0), behenic (22:0) and lignoceric (24:0) acid, are typical of *Leguminosae*. Evrard et al. (1971) emphasized that chain lengths  $> C_{18}$  are taxonomically more important than the degree of unsaturation in case of fatty acid spectra of *Leguminosae*. They assumed that each subfamily might have its own pattern of seed oils: *Caesalpinioideae* with rather variable composition of total fatty acids, but usually with no more than 4% of 20:0 + 22:0 + 24:0, i.e.  $<$  than the amount of 16:0 (for *Afzelia bella* mentioned by these authors see sub Gustone et al. 1967, 1972). *Mimosoideae* with 20:0 + 22:0 + 24:0  $<$  16:0, and with 22:0 + 24:0  $> C_{20}$  (20:0 + 20:1); this latter rule, however, seems to have many exceptions (Chowdhury et al. 1984). *Papilionoideae* with 1.3–9.6% 20:1 (believed to be gadoleic acid), and usually with  $C_{20}$  (20:0 + 20:1)  $>$  than 22:0 + 24:0. In recent times other fatty acids were detected in a number of legume seed oils; they occur in amounts of 1–35% of total fatty acids, and may have some taxonomic meaning. Epoxyoctadecenoic acids (coronaric and/or vernolic acid) are present in seed oils of many species of *Acacia* in amounts of up to 10% (Chowdhury et al. 1983; Ansari & Ahmad 1986; Jamal et al. 1987; Banerji et al. 1988). Brown et al. (1987) showed that all Australian species of *Acacia* lacking an arillus (or funicle or elaiosome) produce seed oils with over 50% of linoleic acid, and that in *Acacia* seed oils oleic acid (18:1n-9) is accompanied by its isomer, vaccenic acid (18:1n-7). *Acacia adsurgens*, *A. coriacea*, *A. cowleana* and *A. tenuississima* had only 17–41% 18:2, but 32–53% 18:1 and 15–20% 16:0 in their whole-seed oils; in this instance 30–62% of the seed lipids were found to be located in the oil-rich elaiosomes (arils); the aril oils differed markedly in their fatty acid spectra (23–35% 16:0, 49–63% 18:1 and only 2–6% 18:2) from the oils derived from seeds lacking an elaiosome. The same observation had already been reported for *Acacia cyclops*, a species introduced from Australia to South Africa; it produces a kernel oil with 6% 16:0, 9% 16:1, 10% 18:1 and 68% 18:2 and an aril oil with c. 20% 16:0, 8% 16:1, 61% 18:1 and only 3% 18:2 (Black et al. 1949). Very recently some unexpected fatty acids were discovered in *Leguminosae* seed oils. Five species of the caesalpinoid genus *Afzelia* have large amounts of the acetylenic crepenynic and dehydrocrepenynic acid (Gustone et al. 1967, 1972), and the Halphen-positive cyclopropenoids malvalic and sterculic acid occur

in seed oils of the caesalpinioids *Cassia grandis* and *C. siamea* and *Delonix elata*, and, together with 10% ricinolic acids, of the papilionoid *Crotalaria retusa* (Daulatabad et al. 1987, 1988, 1989).

*Inositols*: Pinitol not only occurs in seeds of *Leguminosae* as already mentioned, but is also present in leaves, barks, flowers and other parts of most investigated taxa. Hegnauer (1956) stressed that the investigations of Plouvier had established (+)-pinitol as a chemical character of *Leguminosae*; in some taxa it is replaced as main cyclitol by (+)-quercitol, (+)-ononitol or (-)-bornesitol (see Plouvier 1962, 1963, 1965). Dried leaves kept during 20–25 years lost most of the cyclitols originally present (Plouvier 1974); therefore in the case of cyclitols herbarium specimens seem to be scarcely suitable for chemotaxonomic research. Legumes produce (+)-pinitol by epimerisation of (+)-ononitol (Dittrich & Brandl 1987).

*Organic acids*: Most legumes produce appreciable amounts of oxalic acid and deposit it as calcium oxalate in various cell- and tissue-types. Malonic acid is accumulated by many legumes in unusual large amounts, but observations are mostly restricted to papilionoids. Some legumes produce large amounts of tartaric acid which is biogenetically derived from ascorbic acid; its occurrence seems to be erratic, however, and was, to my knowledge, hitherto only observed in some caesalpinioids (*Bauhinia reticulata*, *Tamarindus indica*), mimosoids (*Acacia concinna*) and papilionoids (certain *Phaseolus* cultivars).

*Acidic mucilages produced in vegetative parts*: Mucilage cells occur in leaf epidermata of many *Leguminosae*, but structures of their acidic heteropolysaccharides are scarcely known (Bailey 1971). Gum arabic- and tragacantha-type mucilages or gum exudates are economically important and have been studied thoroughly. Exudate gums are products of trauma-induced gummosis which occurs in many wood legumes. The best known example is the genus *Acacia*, whose species *A. senegal* is the main producer of good quality commercial gum arabic. Anderson et al. paid much attention to chemical, technological and chemotaxonomic aspects of gum of *Acacia* (1969a, 1980; see also Anderson 1978, 1987), *Albizia* (1966, 1969b, 1987), *Prosopis* (1982, 1985) and other taxa, such as *Entada africana* (1987), *Enterolobium cyclocarpum* (1990), *Leucaena leucocephala* (1987), *Lysiloma acapulcensis* (1990). They also investigated the seed pod mucilage of *Parkia nitida* (1990) which is chemically similar to the exudate gums. The Anderson group showed that each species produces a taxon-characteristic gum and that gum exudates are usually highly complex proteoglycans or glyco-proteins (Anderson 1987). *Acacia* gums contain 0.2–45% protein with a high percentage of hydroxyproline. This rather unusual amino acid is also present in large amounts in the proteinaceous part of gum exudates of species of *Entada*, *Leucaena*, *Lysiloma*, *Parkia* and *Prosopis*, but is much less prominent in the proteins of gum exudates of *Albizia* species and of *Enterolobium cyclocarpum*. The heteropolysaccharide part of mimosoid gum exudates has galactose, arabinose and glucuronic acid and its 4-methylether as main building stones; additional sugars which are sometimes present in appreciable amounts are rhamnose, xylose, and, in *Albizia*, mannose. The protein and heteropolysaccharide parts of the gums are chemically interlinked and the gum molecules are highly branched and of great complexity. The Scottish workers (Anderson et al. 1980) investigated 15 species of the section *Juliflorae* (extratropical and tropical Australia, Southeast Asia, Pacific Islands) of the genus *Acacia*, and showed

that gum composition is heterogeneous within this series and does not agree with the subseries discerned by Bentham; they offered a new informal grouping of the 15 investigated species that promises to be more natural in the light of available morphological evidence.

**Flavonoids:** Hegnauer (1956) suggested that a chemotaxonomic discussion of flavonoids of *Leguminosae* should also include isoflavonoids, rotenoids and stilbenes, because plant phenols with a  $C_{14}$  (stilbenes),  $C_{15}$  (chalcones, flavones, isoflavones, and related flavonoids and isoflavonoids) and  $C_{16}$  (rotenoids and pterocarpans) basic skeleton are biogenetically intimately related. He also stressed the pluriformity of flavonoid metabolism of legumes. Some examples should suffice to illustrate the immense diversity of flavonoids produced by this taxon. Besides producing trivial compounds as the flavonols kaempferol and quercetin, the flavones apigenin and luteolin, and their 2,3-dihydro derivatives, many legumes also accumulate C-glycosides of flavones and even isoflavones, flavonoids with trihydroxylate B-ring [e.g. myricetin, the prosogerins (Bhardwaj et al. 1978–1981)], are able to methylate phenolic hydroxyls and to form methylenedioxy groups from a hydroxyl and a vicinal methoxyl, and to perform C-prenylations and C-methylations [e.g. *Prosopis juliflora* flavones (Malhotra & Misra 1983)]. Prenylation of flavonoids seems to be rare in caesalpinjioids and mimosoids, but the cedrelins A and B from *Cedrelinga catenaeformis* (Ezaki et al. 1991) illustrate the fact that prenylation of phenolic compounds does not occur in the *Mimosoideae*. Moreover, the common 3,5,7,3',4'-hydroxylation pattern is frequently supplemented by additional hydroxylations in position 6,8,2' and 6'; examples are patuletin and patulitrin of pods of *Prosopis (Lagonychium) farcta* (Kéry et al. 1985) and two O-methylated derivatives of gossypetin from aerial parts of *Prosopidastrum globosum* (Agnese et al. 1986). Taxonomically perhaps even more important (Gornall et al. 1979; Lowry et al. 1976) is the fact that members of all three legume subfamilies produce a large number of 5-deoxy flavonoids. The ability to remove the 5-hydroxyl of the acetogenic A-ring during flavonoid biosynthesis is regarded to be a key character of *Leguminosae* which they share with *Anacardiaceae* (Gornall et al.). The 5-deoxy structure is also shown by many catechins and leucoanthocyanidins of legumes; these will be mentioned sub tannins. Another striking feature is the fact that 2-arylchromones (flavonoids) are accompanied or replaced in certain leguminous plants or plant parts by 3-arylchromones (isoflavonoids) or even 4-arylchromans (brasilin, haematoxylin). Since the 1956 publication of Hegnauer an enormous amount of new evidence accumulated; it confirms suggested phytochemical tendencies and clearly indicates that legumes are unique in several respects of their flavonoid metabolism. Firstly they produce the majority of presently known isoflavonoids (isoflavones, pterocarpanes, rotenoids) of which, moreover, many are 5-deoxy compounds. Most isoflavonoid metabolites were detected in a number of tribes of *Papilionoideae*, but true isoflavones and pterocarpanes are by no means totally lacking in the two other legume subfamilies. Examples from *Mimosoideae* are genistin from flowers of *Acacia arabica* (= *A. nilotica*) (Mostafa et al. 1980), biochanin A, formononetin, daidzein, genistein and a pterocarpin from wood and bark of *Albizia procera* (Deshpande & Shastri 1977) and retusin 7-neohesperidoside from the bark of *Prosopis juliflora* (Vajpeyi & Misra 1981). Only rotenoids with a basic  $C_{16}$  skeleton are restricted to relatively few genera of *Papilionoideae* within the legume family; they seem



to be replaced in some caesalpinoids and mimosoids by the C<sub>16</sub>-peltogynoids which are flavone or flavan analogues of the rotenoids. Peltogynoids occur, e.g., in several species of *Acacia* (Brandt et al. 1979, 1981; Van Heerden et al. 1981); the name of this class of compounds is derived from the caesalpinoid genus *Peltogyne*. The number of publications treating chemical and biological aspects of flavonoid metabolism of *Leguminosae* is extremely large; it is, however, well covered in the three volumes 'The Flavonoids' (1975, 1982, 1988) published by Harborne et al. For chemotaxonomic discussions see Harborne (1971), Jay et al. (1971), Cagnin & Gottlieb (1978) and Gornall et al. (1979), and for a chemical survey devoted to *Leguminosae* Torck (1976) can be consulted. A. S. Rao (1990) reviewed comprehensively root flavonoids and their manifold biological effects, including their role in establishing the legume-*Rhizobium* symbiosis.

**Tannins:** Tannins occur widely in leguminous plants. Some taxa accumulate large amounts and are valuable vegetable tanning materials. Every part of a given species, i.e. roots, bark, wood, leaves, flowers, fruits and seeds, may attain a high tannin content. It mainly depends on the species which part is richest in polyphenolics. As a rule woody tropical and subtropical legumes produce more tannins than herbaceous extratropical ones, but herbaceous representatives may vary widely in tannin content of their leaves; much work was performed with tannin-containing herbaceous fodder legumes (e.g. Bate-Smith 1973, 1975). Generally two main types of tannins are distinguished: a) *Flavonoid tannins* which have mainly catechins (flavan-3-ols) and leucoanthocyanidins (flavan-3,4-diols) as building stones. Leucoanthocyanidins with a hydroxyl in 5-position are very unstable and seem to be seldom present in plants in easily detectable amounts. Since one of the outstanding biochemical features of *Leguminosae* is the possibility to produce 5-deoxy flavonoids (see sub flavonoids), they are also able to synthesize and accumulate a larger number of much more stable 5-deoxy leucoanthocyanidins; the latter have A-rings with a resorcinol or pyrogallol hydroxylation pattern instead of the usual phloroglucinol-substitution. Condensation of the flavan-3-ol and flavan-3,4-diol building stones results in C-C-linked oligomers (= *condensed tannins*) and finally in insoluble polymers known as phlobaphenes or tanner's red. Wattle bark, usually harvested from *Acacia mearnsii*, is one of the most important vegetable tanning materials; it contains only condensed tannins. Condensed tannins together with their building stones and phlobaphenes are presently often termed proanthocyanidins (PA), because they yield anthocyanidins on treatment with mineralic acids. b) *Hydrolysable tannins* are esters (seldom glycosides; see *Prosopis*) of polyalcohols (often glucose) with phenolic compounds which are preferentially gallic and hexahydroxydiphenic acid; they are called gallotannins (only gallic acid present) and ellagitannins (generate ellagic acid on hydrolysis by spontaneous lactonization of hexahydroxydiphenic acid). The nature of tannins present in a plant not only depends on its systematic position, but also on plant parts. PA are the main tannins in most *Leguminosae*. Formerly gallo- and ellagitannins were thought to be restricted to fruits of some *Caesalpinioideae*, notwithstanding the fact that gallic acid and monoesters of gallic acid are known from many legumes. Recently, however, a number of mimosoids was shown to produce several types of hydrolysable tannins. Fresh leaves of Egyptian *Acacia raddiana* yielded an ellagitannin and several galloylglucoses (El-Mousallamy et al. 1991), and bark of Indian *A. leucoxloea* contains  $\beta$ -glucoside with a pentagalloylated sugar part (Trivedi & Misra 1984).

South African *A. gerrardii* has mono- and digalloylated catechins in the tannin fraction of its bark (Malan & Pienaar 1987, 1990). Such compounds are more or less intermediate between the two main tannin types just mentioned, because they have gallic acid esterified with one of the building stones of condensed tannins. Similar compounds occur in the tannin-rich bark and pods of the highly polytypic Afroasian *A. nilotica* (Hussein Ayoub 1984; Malan 1991); in Africa extracts of pods and bark of this taxon have been tried as a molluscicide. Roots and pods of a *Prosopis* taxon believed to be *P. juliflora* were investigated in India; they yielded besides PA several ellagitannins of a special type; ellagitannins of this taxon were shown to contain esters of O-methylated hexahydroxydiphenic acid and glycosides of O-methylated ellagic acids (Malhotra & Misra 1981, 1982, 1983). Tannins are highly complex mixtures of polyphenolic compounds. Haslam suggested that the term tannins should be replaced by *plant polyphenols*; to me this seems to be an inappropriate proposal, because many natural polyphenols differ profoundly in structure and properties from the complex mixtures of compounds presently known as tannins. Many aspects of tannin chemistry and biology are treated by Roux (1972), Roux & Ferreira (1982), Haslam & Lilley (1985), Porter (1988), Hemingway & Karachesy (1989), Haslam (1989) and Ferreira et al. (1992).

**Alkaloids:** Many legumes contain alkaloids, and an astonishingly large number of alkaloidal classes was detected hitherto in this taxon. However, the best known and most widespread, the lysine-derived quinolizidines, the ornithine-derived pyrrolizidines and the phenylalanine-tyrosine-derived erythrinanes are restricted to *Papilionoideae*. Mears & Mabry (1971) comprehensively treated alkaloids of Leguminosae and Smolensky & Kinghorn (1981) prepared a supplementing review of alkaloids of *Caesalpinioideae* and *Mimosoideae*. Many mimosoids accumulate appreciable to large amounts of simple amines derived from phenylalanine, tyrosine (see also Smith 1977), tryptophan, and even histidine. Such so-called biogenic amines are often biologically active compounds which can cause troubles in man and cattle (e.g., Evans et al. 1979). They occur in bark, leaf, flowers, pods and/or seeds in taxon-characteristic numbers and combinations in many species of *Acacia* (*Acacieae*), but were detected also in species of *Anadenanthera*, *Entada*, *Mimosa*, *Monoschisma*, *Piptadenia* and others (*Mimoseae*), *Albizia*, *Calliandra*, *Pithecellobium* and others (*Ingeae*). Evans et al. showed that storage of up to 0.5% of N-methyltyramine in seeds is a character of the *pennata* group of Benthams' *Acacia* taxon *Vulgares*. Sometimes biogenic amines of *Mimosoideae* are accompanied by simple true alkaloids which probably arise by combining an amide with formaldehyde or acetaldehyde. Examples are calycotomine (calicotomine) reported from *Acacia concinna* and harman- and norharman-type alkaloids present in a number of species of *Acacia*, *Anadenanthera* (*Piptadenia*) and *Prosopis* (Allen & Holmstedt 1980). An interesting group of alkaloids is represented by the 2,6-dialkylated piperidines which occur in large numbers in members of the genera *Cassia* (*Caesalpinioideae*) and *Prosopis* (*Mimosoideae*); they probably have an acetogenic origin and may additionally include a dehydroindolizidine ring; examples of the latter variants are the complex alkaloids juliprosopine (= juliflorine) and julifloricine of *Prosopis juliflora* [see e.g. Roy. Soc. Chem.: Natural Products Reports 6 (1989) 529]. The series of homologous monocyclic polyamines known as pithecolobine from *Pithecellobium saman* (*Samanea saman*) and other *Pithecellobium* species and the chemically very similar budmunchi-



amines from *Albizia amara* (Pezzuto et al. 1991) form another group of mimosaceous alkaloids. Recently Tantisewie (1992) reported the isolation of an *Equisetum*-alkaloid, palustrine, from *Albizia myriophylla* from Thailand; this is a dicyclic spermine derivative and consequently another type of polyamine. In 1894 paucine was described as an alkaloid from seeds of *Pentaclethra macrophylla*, also known as 'pauc nuts'. Hollerbach & Spiteller (1970) showed that it is monocaffeoylputrescine, and Mbadiwe (1973) prepared it as a crystalline hydrochloride dihydrate in 1.4% yield from fresh seed kernels of Nigeria; paucine is another amine derivative of mimosoids. Nicotine was detected in a few species of *Acacia*; it may be present in appreciable amounts (*A. concinna*). Much information about the nature and biological properties of plant constituents, including alkaloids of many *Mimosoideae*, is given in the book of Collins et al. (1990). Hegnauer suggested in 1956 that *Leguminosae* seem to try out practically all known metabolic pathways leading to alkaloid accumulation, but usually are not able to surmount the initial steps, if exception is made for the already mentioned quinolizidines, pyrrolizidines and erythrinanes of a number of papilionoid taxa. Essentially this suggestion seems to be still valid.

**Diterpenes and balsams:** Certain woody legumes have a tendency to produce oleoresins or balsams if the anatomical prerequisites, excretory cavities, exist. Such cavities may be present in bark, wood, leaves and pods and occur predominantly in some tribes of *Caesalpinioideae* and *Papilionoideae*. However, oleoresins can also be deposited in woods without excretory cavities. Products like balsam of copaiba and legume copals are predominantly mixtures of diterpenoids and sesquiterpenes. They can be considered as sesquiterpene analogues of the better known turpentine of conifers and certain *Anacardiaceae* which are mixtures of diterpenoids and monoterpenes. Balsam of Peru and Balsam of Tolu are traumatic products containing mainly aromatic compounds; they are produced with members of the papilionoid tribe *Sophoreae* and are not considered here. One gets the impression, that balsam production in *Detarieae* (*Caesalpinioideae*) and gummosis which occurs frequently in many mimosoid taxa are in some way vicarious processes. However, diterpenes are by no means totally lacking in *Mimosoideae*. Langenheim (1981) reviewed terpenoids of *Leguminosae*, but his paper is far from comprehensive and new information became available since it was written. Diterpenes are presently known from woody parts (roots, stems, branchlets) of species of *Plathymenia* and *Xylia* (*Mimoseae*) and from several *Acacia* taxa (*Acacieae*). Labdane-type diterpenes were isolated from a western Australian taxon of *Acacia* (Foster et al. 1985). *Xylia dolabriformis* (= *X. xylocarpa*) yielded six compounds with the pimarane-skeleton (Laidlaw & Morgan 1963), and three pimarane-type diterpenes were isolated from root bark of *Acacia leucophloea* (Bansal et al. 1980). Wood of *Plathymenia foliolosa* and *P. reticulata* contains methyl vinhaticolate and vinhaticyl acetate, two cassanetype tricyclic diterpenes (Matos et al. 1984) and a clerodane-type compound,  $C_{20}H_{34}O$ , called plathyterpol (King & Rodrigo 1967). Two derivatives of 7,8-seco-cassane were isolated by Joshi et al. (1979) from roots of *Acacia jacquemontii*. It should be mentioned at this point that the cassane-type of diterpenes is relatively frequent in *Caesalpinioideae* as exemplified by the usually bitter caesalpines of seeds of *Caesalpinia* taxa and by the main toxic 'alkaloids' of the genus *Erythrophleum* which are in fact diacidic cassanoids esterified with N-methyl- or N,N-dimethylethanolamine (see for *Erythrophleum chlorostachys* Collins et al. 1990: 90, 144).

*Triterpenes and saponins:* Saponins are common constituents of *Leguminosae*. A survey based on personal observations was published by Lindner (1946); he reported presence of saponins in the mimosoid genera *Acacia*, *Adenanthera*, *Albizia*, *Calliandra*, *Entada*, *Enterolobium*, *Pithecellobium* and *Piptadenia*. Sapogenins of *Leguminosae* are tetracyclic (e.g. *Astragalus*) or pentacyclic triterpenes and exceptionally (*Trigonella*) C<sub>27</sub>-steroids. *Mimosoideae* seem to be the saponin-richest taxon of legumes; they preferentially produce saponins based on acidic derivatives of  $\beta$ -amyrin-type pentacyclic triterpenes; examples of frequently encountered sapogenins are oleanolic acid and a number of oxygenated derivatives and 18-epimers, such as acacic, echinocystic, entagenic, machaerinic and proceric acid. Occasionally other triterpenic acids occur as sapogenins. Betulinic acid was observed as sapogenin of a root saponin of *Acacia leucophloea*. 27-Hydroxybetulinic acid (cylicodiscic acid) and maslinic acid (2-hydroxyoleanolic acid) are sapogenins of the bark saponins of *Cylicodiscus gabunensis* (Tchivounda et al. 1990, 1991). Every part of a mimosaceous plant may store appreciable to large amounts of saponins. Saponin-structures can be simple to highly complex. Aridanin from pods of *Tetrapleura tetraptera* is a 3-monoglycoside of oleanolic acid; it is exceptional, however, that its single hexose is the aminosugar N-acetylglucosamine (= 2-deoxy-2-acetoaminoglucose). Fruits of *Enterolobium contortisiliquium* yielded the 3-glucoside of 21-cinnamoylmachaerinic acid; in this instance the sapogenin is an aromatic triterpene ester. Entadasaponin III (ES-III), one of the main saponins of the bark of *Entada phaseoloides*, illustrates the group of highly complex saponins. It is a bisdesmosidic saponin with echinocystic acid as a sapogenin, a branched tetrasaccharid containing one N-acetylglucosamine moiety linked with OH-3, and a branched biacylated tetrasaccharide linked with the 28-carboxyl; one of the acyl groups is furnished by acetic acid and the others by a monoterpene hydroxyacid. To my knowledge the soyasapogenol-type hydroxylated  $\beta$ -amyrins which occur frequently as sapogenins in certain *Papilionoideae* have not yet been detected in *Mimosoideae*. Excellent reviews of the chemistry and distribution of triterpenic sapogenins and saponins of known structure exist: Hiller et al. (1966–1980); Adler & Hiller (1985); ‘Saponin Reviews’ of Indian authors (1967–1991). Usually saponins are present as complex mixtures in plant parts. Many individual saponins are biologically active compounds. The use of a number of mimosoid crude drugs as piscicides, soap substituents, molluscicides, anthelmintics and for several medical purposes is probably based on certain of the saponins they contain. Free triterpenes, such as  $\beta$ -amyrin, lupeol, betulin, taraxerol, friedelanol, friedelin and onocerol are widespread in *Leguminosae* and usually represent part of cuticular and cork waxes and of other lipid fractions.

*Some erratically occurring and/or toxic constituents:* Anthraquinones are common constituents of the caesalpinoid genus *Cassia*; recently galangin-3-rhamnoside and 3 anthraquinone rhamnosides were isolated from roots of *Acacia leucophloea*; one of the anthra-glycosides, 1,3,5-trihydroxy-8-methoxy-2-methylanthraquinone-3-rhamnoside, was already known from the bark of *Melia azedarach*; the two others have similar substitution patterns (Saxena & Srivastava 1986). Wood of Australian *Acacia melanoxylon* has allergenic properties; the causative principles were shown to be 2,6-dimethoxybenzoquinone and the more active phenylpropanoid benzofuranoquinone acamelin with the chemical name 6-methoxy-2-methyldihydrobenzofuran-4,7-dione (Schmalle & Hausen 1980). Roots of *Acacia jacquemontii* yielded tectol (Joshi et al. 1979), a dimer derived from the

naphthoquinone deoxylapachol; it is therefore possible that this taxon also has allergenic properties. Lignans,  $(C_6-C_3)_2$ , are rarely present in appreciable amounts in *Leguminosae*; this perhaps is not astonishing in a taxon accumulating huge amounts of flavans and flavonoid  $(C_6-C_3-C_6)$  compounds. Small amounts of a series of lignan glycosides and related phenolic constituents were isolated from the bark of *Albizia julibrissin* which is a crude drug of Chinese medicine (Higuchi et al. 1992a). Bark of *Acacia tortilis* subsp. *raddiana* (called 'Qurac') is used as an antiasthmatic in Somalia; it yielded the diphenylpropane-2-ol derivatives quaracol A and B as active principles (Hagos et al. 1987); similar compounds are the virolanols from wood of *Virola elongata* (*Myristicaceae*), where they co-occur with the related 5-deoxy catechin (-)-fisetinidol; the latter is also present in *Acacia mearnsii* and other mimosoids. Phaseoloidin is a glucoside of homogentisic acid (= 2,5-dihydroxyphenylacetic acid) of seeds of *Entada phaseoloides* (Barua et al. 1988); it is accompanied by the 5-butylether and by the free acids and a glucoside of entadamide A (Dai et al. 1991). The entadamides A to C are amides of cysteine and 2,3-dehydrocysteine derivatives with ethanolamine; they were isolated from seed kernels and leaves of *Entada scandens* (Ikegami et al. 1985, 1987, 1989). (+)-Acacialactam,  $C_{10}H_{15}NO$ , is a 3,7-dimethyl-7-vinyl-tetrahydroazepin-2-one; it was isolated from seeds of *Acacia concinna* which have medical uses in Thailand (Sekine et al. 1989). Pyridoxine, a pyridine derivative, is known as vitamin B<sub>6</sub>; it is a vital coenzyme; its 4'-methylether, 3-hydroxy-5-hydroxymethyl-4-methoxymethyl-2-methylpyridine, is a vitamin B<sub>6</sub> antagonist and known as a neurotoxin. This compound was isolated from *Albizia tanganyicensis*, its 3-glucoside is present in seeds of *Albizia lucida* (= *A. lucidior*) (Orsini et al. 1989), and together with two apiose containing biosides, julibrine I and II, in the bark of *Albizia julibrissin*; julibrine II has a cardiotoxic effect in frogs (Higuchi et al. 1992b). Similar pyridoxine antagonists may be widespread in plants, but seldom be stored in amounts that render them toxic; the first isolation of the 4'-methylether of pyridoxine was performed with seeds of *Ginkgo biloba* which can produce symptoms of poisoning when consumed in too large amounts in Japan. Mimosoids causing sometimes poisoning of sheep and cattle in Australia are *Neptunia amplexicaulis*, a selenium accumulator, and *Acacia georginae*, which is able to produce large amounts of fluoroacetate and to deposit it in leaves, pods and seeds (Everist 1981). Many species of *Acacia* can be toxic to cattle in Africa, Australia and the Americas, because they accumulate cyanogenic glycosides in leaves and pods. A comprehensive review of the distribution of cyanogenesis and cyanogenic compounds in *Leguminosae* was published by Seigler et al. (1989). In the genus *Acacia* several pathways to cyanogenic glycosides are realized. Australian species of subgenus *Heterophyllum* Vassal (= subg. *Phyllodineae*) use the phenylalanine pathway and produce prunasin or sambunigrin, and African, Asian and American species of subgenus *Acacia* use aliphatic amino acids. Those starting with valine and isoleucine store linamarin and lotaustralin and those making use of leucine accumulate proacacipetalin- and 3-hydroxy-heterodendrin-type cyanogenic glycosides. In this instance "the distribution of the major pathways leading to production of cyanogenic compounds ... generally correlates with currently accepted taxonomic concepts" (Seigler et al. 1989).

*Phytoalexin*-production is widespread in *Leguminosae*, but has not yet been traced in *Mimosoideae* (Ingham 1981).



*Nyctinastins*: Many *Leguminosae* are able to close their leaves by movements which are either periodical ('sleeping' positions of leaves and leaflets during night) or abrupt in sensitive plants like *Mimosa pudica*. The chemistry underlying leaf movement processes was studied by Schildknecht and his group (Schildknecht et al. 1982, 1986), Bielenberg et al. (1984) and Miyoshi et al. (1987), and the daily leaf movements were analyzed by Herbert (1989). It became clear that nyctinastic movements are based on a complex stimulation chain having many members. Some of these members were identified by Schildknecht's group as free amino acids (alanine and glutamic acid), (+)-pinitol acetate, gentisic acid 5-bioside (LMF1), two cyclic nucleotides (LMF2 and 3) and six acidic sulfates of monoglucosides or monoallosides of gallic and 4-hydroxybenzoic acid (PLMF1 to 6). Later Miyoshi et al. (1987) showed that potassium chelidonate is also involved in leaf-closing of *Mimosa pudica* and other *Leguminosae*, and that different species of nyctinastic legumes react differently to the already known turgorines.

*Nodulation and symbiotic nitrogen-fixation*: Most leguminous plants are able to collaborate with *Rhizobium*-type bacteria to gain essential nitrogen-containing compounds from atmospheric nitrogen. This symbiotic nitrogen-fixation takes place in root nodules, whose taxonomic aspects were discussed by Corby (1981). Verma & Stanley (1989) state "Thus coevolution in plant and bacteria has given rise to present-day legumes." For comprehensive reviews of many aspects of the highly complex processes of legume nodulation and subsequent nitrogen-fixation see Summerfield & Bunting (1980), Allen & Allen (1981) and the first three chapters in Poulton et al. (1989). Consult Rao (1990) for the role of flavonoid root exudates of legumes as initiators of nodulation. The fact that 40–65% of organic nitrogen present in *Prosopis* growing in the Sonoran desert of Southern California is derived from symbiotic nitrogen fixation (Kohl & Shearer 1989) illustrates the enormous importance of legumes for soil amelioration, agroforestry and protein production.

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## KEY 1 TO THE GENERA

(based primarily on vegetative as well as on flower and fruit characters)

- 1a. Terminal pair of pinnae transformed into tendrils. – Lianas or shrubs with climbing branches . . . . . **Entada** (p. 176)
- b. Terminal pair of pinnae provided with unipinnate leaflets. – Trees, shrubs, or lianas 2
- 2a. Leaves apparently simple, being modified to phyllodes (also cultivated)
  - Acacia** p.p. (p. 34)
- b. Leaves uni- or bipinnate . . . . . 3
- 3a. Leaves unipinnate (cultivated) . . . . . **Inga** Mill.
- b. Leaves bipinnate (unifoliolate leaves with two joints on the leaflet stalk) . . . . . 4
- 4a. Leaves without extrafloral nectaries on petioles, rachises and pinnae . . . . . 5
- b. Leaves with extrafloral nectaries on petioles, rachises and/or pinnae . . . . . 13
- 5a. Stems unarmed . . . . . 6
- b. Stems armed . . . . . 12
- 6a. Climber (with leaves sensitive to the touch) (also cultivated)
  - Mimosa** (*M. diplotricha* var. *inermis*) (p. 185)
- b. Erect trees or shrubs . . . . . 7
- 7a. Leaflets 1½ or 2 pairs per pinna, proximal leaflets most often unpaired
  - Archidendron** (*A. trifoliolatum*) (p. 120)
- b. Leaflets more than 6 pairs per pinna . . . . . 8
- 8a. Leaflets alternate. Seeds red or partly red (also cultivated) **Adenanthera** (p. 165)
- b. Leaflets opposite . . . . . 9
- 9a. Juvenile shoots, inflorescence and leaves covered by stellate hairs. Introduced from Brazil . . . . . **Mimosa** (*M. scabrella* Benth.)
- b. Plant without stellate hairs . . . . . 10
- 10a. Stamens 8. Valves of fruits forming one-seeded segments at maturity, leaving the sutures as an empty frame (cultivated) . . . . . **Mimosa** (*M. bimucronata*) (p. 184)
- b. Stamens numerous. Valves of fruits not forming one-seeded segments at maturity 11
- 11a. Stamens united at the base, bright red or pink at least distally. Fruit with two thickened margins, elastically dehiscent from the apex (cultivated) . . . **Calliandra** Benth.
- b. Stamens free to the base, white. Fruit without thickened margins, not elastically dehiscent from the apex (cultivated) . . . . . **Acacia** [*A. glauca* (L.) Moench.]
- 12a. Fruit ± separating in individual segments or if central part of fruit separating as one piece, then peduncle not prickly. Stems hairy or bristly (in Malesia)
  - Mimosa** (p. 183)
- b. Fruit valves each separating as one unit from a ± persistent replum; peduncle prickly. Stems glabrous (in cultivated species) . . . . . **Schrankia** Willd.
- 13a. Stems armed . . . . . 14
- b. Stems unarmed . . . . . 22
- 14a. Stems armed by a single, recurved prickly from the base of the leaf-scar
  - Albizia** p.p. (p. 64)
- b. Stems without a single, recurved prickly . . . . . 15

- 15a. Short-shoots terminated by spines or composed of many persistent fused stipules and (sometimes) bracts. Fruits erect, oblanceolate and opening from the apex. Neuter or non-functional male flowers at the base of the inflorescence  
**Dichrostachys** (p. 174)
- b. Short-shoots without terminal spines . . . . . 16
- 16a. Stems armed with recurved prickles at the internodes or prickles paired just below the nodes . . . . . **Acacia** (subg. **Aculeiferum**) (p. 47)
- b. Stems armed with spinescent stipules . . . . . 17
- 17a. Stipules recurved and hook-like. Flowers in corymbs  
**Albizia** (*A. pedicellata*) (p. 78)
- b. Stipules  $\pm$  straight and erect. Flowers in glomerules or spikes . . . . . 18
- 18a. Flowers in spikes . . . . . 19
- b. Flowers in glomerules or umbels . . . . . 20
- 19a. Fruits chartaceous. Stamens 15 (also cultivated) . . . . . **Acacia** p.p. (p. 34)
- b. Fruits drupaceous. Stamens 10 . . . . . *Prosopis* L.
- 20a. Leaves with 1 pair of pinnae, each pinna with 1 pair of leaflets (also cultivated)  
**Pithecellobium** (p. 154)
- b. Leaves with more than 2 pairs of leaflets on each pinna . . . . . 21
- 21a. Flowers heteromorphic within the same inflorescence unit; filaments united in a tube. Pods brown, falling apart in one-seeded indehiscent segments **Cathormion** (p. 143)
- b. Flowers uniform, filaments free. Pod rarely moniliform and, if so, greyish (also cultivated) . . . . . **Acacia** (subg. **Acacia**) (p. 44)
- 22a. Pinnae unifoliolate, i.e. with a single leaflet and with two scars on the stalk  
**Archidendron** ser. **Morolobiae** (p. 135)
- b. Pinnae with at least one pair of leaflets . . . . . 23
- 23a. Aquatic or terrestrial herbs . . . . . 24
- b. Trees or shrubs . . . . . 25
- 24a. Stipules subulate. Fruits sessile, linear, with oblique or longitudinal seeds (cultivated) . . . . . *Desmanthus* Willd.
- b. Stipules ovate to lanceolate, striately veined. Fruits stipitate, narrowly to broadly oblong with seeds  $\pm$  transverse . . . . . **Neptunia** (p. 186)
- 25a. Inflorescences consisting of pedunculate pendulous clavate heads, receptacle enlarging in the fruiting stage (also cultivated) . . . . . **Parkia** (p. 193)
- b. Inflorescences pendulous or not, not consisting of clavate heads, receptacle not enlarging in the fruiting stage . . . . . 26
- 26a. Leaflets alternate, except perhaps for the distal two (always more than two alternate pairs per pinna) . . . . . 27
- b. Leaflets opposite, if only two pairs of leaflets per pinna the proximal pair rarely alternate . . . . . 28
- 27a. Leaflets petiolulate. Flowers in pedunculate axillary corymbs. Pods curved into a circle or contorted, reddish inside, dehiscent . . . . . **Pararchidendron** (p. 145)
- b. Leaflets sessile. Flowers in compound inflorescences. Pods straight, not reddish inside, usually indehiscent (or tardily dehiscent) . . . . . **Serianthes** (p. 157)

28a. Specimen flowering . . . . .	29
b. Specimen in fruit . . . . .	55
29a. Stamens 10, free . . . . .	30
b. Stamens more than 10 . . . . .	33
30a. Anther-glands absent. . . . .	31
b. Anther-glands present . . . . .	32
31a. Leaflets broadly elliptic(-lanceolate), 3.8–14 by 2.4–6.7 cm. Anthers glabrous (cultivated) . . . . .	<i>Xylia</i> Benth
b. Leaflets linear or linear-oblong, 0.6–2.1 by 0.15–0.5 cm. Anthers hairy (also cultivated) . . . . .	<b>Leucaena</b> (p. 182)
32a. Leaflets broadly elliptic(-lanceolate), 3.8–14 by 2.4–6.7 cm . . . . .	<i>Xylia</i> Benth.
b. Leaflets oblong . . . . .	<b>Schleinitzia</b> (p. 190)
33a. Filaments free (cultivated) . . . . .	<i>Acacia</i> [sect. <i>Botrycephalae</i> (Benth.) Taub.]
b. Filaments united, forming a tube (tribe <i>Ingeae</i> ) . . . . .	34
34a. Flowers uniform within an inflorescence unit, i.e. without an enlarged central flower with an intrastaminal disc . . . . .	35
b. Flowers heteromorphic within an inflorescence unit . . . . .	54
35a. Inflorescences simple . . . . .	36
b. Inflorescences compound. . . . .	42
36a. Flowers subtended by bracts with an extrafloral nectary . . . . .	<b>Archidendron</b> (p. 86)
b. Flowers subtended by eglandular bracts or bracts inconspicuous. . . . .	37
37a. Inflorescence pendulous . . . . .	<b>Archidendron</b> (p. 86)
b. Inflorescence erect . . . . .	38
38a. Leaflets sessile. . . . .	39
b. Leaflets stalked . . . . .	40
39a. Stipules present in the mature plant . . . . .	<b>Paraserianthes</b> ( <i>P. lophantha</i> ) (p. 149)
b. Stipules absent in the mature plant . . . . .	<b>Archidendropsis</b> p.p. (p. 141)
40a. Flowers pedicellate . . . . .	41
b. Flowers sessile . . . . .	<b>Archidendropsis</b> p.p. (p. 141)
41a. Ovary solitary . . . . .	<b>Wallaceodendron</b> (p. 162)
b. Ovaries 3–5 per flower . . . . .	<b>Archidendropsis</b> p.p. (p. 141)
42a. Flowers subtended by bracts with an extrafloral nectary . . . . .	<b>Archidendron</b> (p. 86)
b. Flowers not subtended by persistent bracts with nectaries . . . . .	43
43a. Basic unit of inflorescence a raceme or a spike . . . . .	44
b. Basic unit of inflorescence a glomerule, corymb or an umbel . . . . .	46
44a. Stipules visible in the mature plant, basic unit of inflorescence a raceme . . . . .	<b>Archidendropsis</b> ( <i>A. sepikensis</i> ) (p. 142)
b. Stipules not visible in the mature plant . . . . .	45
45a. Basic unit of inflorescence a spike (flowers sessile) <b>Paraserianthes</b> p.p. (p. 148)	
b. Basic unit of inflorescence a raceme (flowers pedicellate) . . . . .	<b>Archidendron</b> p.p. (p. 86)
46a. Flowers pedicellate . . . . .	<b>Archidendron</b> p.p. (p. 86)
b. Flowers sessile . . . . .	47



- 47a. Leaflets sessile. . . . . 48  
 b. Leaflets petiolulate . . . . . 51  
 48a. Main vein of leaflets diagonal or nearly so. Glomerules of 2 or 3 flowers  
     **Archidendron** (*A. contortum*) (p. 100)  
 b. Main vein of leaflets not diagonal. Glomerules of more than 10 flowers . . . . . 49  
 49a. Petiolar gland bowl-shaped, margin with sharp rim  
     **Albizia** (*A. westerhuisii*) (p. 85)  
 b. Petiolar gland circular to elliptic, raised or flat, without sharp rim . . . . . 50  
 50a. Calyx 1–1.5 mm, puberulous to tomentose all over  
     **Albizia** (*A. lebbekoides*) (p. 76)  
 b. Calyx c. 2.5 mm, pubescent especially at the apex of the lobes (cultivated)  
     **Enterolobium** Mart. [*E. cyclocarpum* (Jacq.) Griseb.]  
 51a. Staminal tube equalling or shorter than the corolla tube  
     **Archidendron** p.p. (p. 86)  
 b. Staminal tube longer than the corolla tube, sometimes longer than the corolla . . . . . 52  
 52a. Ovary stipitate . . . . . **Archidendron** p.p. (p. 86)  
 b. Ovary sessile (not known in *Archidendron novoguineense*) . . . . . 53  
 53a. Corolla 15 mm long. Leaves with 1 or 2 pairs of pinnae  
     **Archidendron** (*A. syringifolium*) (p. 120)  
 b. Corolla up to 7(–8) mm long. Leaves with (2–)3–6 pairs of pinnae (also cultivated)  
     . . . . . **Albizia** p.p. (p. 64)  
 54a. Central flower with 7 or 8 perianth segments (also cultivated) . . **Samanea** (p. 155)  
 b. Central flower with 5 perianth segments (also cultivated) . . . **Albizia** p.p. (p. 64)  
 55a. Seeds without pleurogram . . . . . 56  
 b. Seeds with pleurogram . . . . . 57  
 56a. Pods usually spirally contorted, reddish orange especially on the inner surface with  
     contrasting bluish black seeds, if straight then turgid with disc-like or bitruncate  
     seeds . . . . . **Archidendron** (p. 86)  
 b. Pods (not known mature in Malesian species) straight and flattened, brownish.  
     Seeds presumably brown, strongly flattened, coin-like, with a narrow wing  
     . . . . . **Archidendropsis** (p. 141)  
 57a. Infructescence unit a spike or a raceme (i.e. rachis prolonged with spaced, scattered  
     scars of fallen flowers) . . . . . 58  
 b. Infructescence unit a glomerule or a corymb (i.e. rachis short, with closely set scars  
     of the fallen flowers). . . . . 59  
 58a. Endocarp forming one-seeded envelopes . . . . . **Wallaceodendron** (p. 162)  
 b. Endocarp not forming one-seeded envelopes . . . . . **Paraserianthes** (p. 148)  
 59a. Seeds with horseshoe-shaped, double pleurogram on each side  
     . . . . . **Albizia** p.p. (p. 64)  
 b. Seeds with a single pleurogram on each side . . . . . 60  
 60a. Fruits splitting along both margins for a short distance to let the seeds escape, but  
     not fully opening; with two wings . . . . . **Schleinitzia** (p. 190)  
 b. Fruits either indehiscent or fully dehiscent, not winged . . . . . 61



- 9a. Leaflets alternate . . . . . **Adenanthera** (p. 165)
- b. Leaflets opposite. . . . . 10
- 10a. Plants unarmed. . . . . 11
- b. Plants armed with prickles on the internodes . . . . . 13
- 11a. Scandent shrubs or lianas. The distal pair of pinnae transformed into tendrils. Flowers in spikes . . . . . **Entada** (p. 176)
- b. Trees or erect shrubs. Flowers in glomerules. . . . . 12
- 12a. Valves of fruit forming one-seeded segments at maturity leaving the sutures as an empty frame . . . . . **Mimosa** p.p. (p. 183)
- b. Valves of fruit not forming one-seeded segments (India–Thailand, Indochina)  
*Xylia* [*X. xylocarpa* (Roxb.) Taub.]
- 13a. Fruit  $\pm$  separating into individual segments to leave a persistent replum or if central part of pod separating as one piece the peduncle not prickly . . . **Mimosa** (p. 183)
- b. Valves of fruit separating as one unit from a  $\pm$  persistent replum. Peduncle prickly  
*Schrankia* Willd.
- 14a. Filaments free or shortly united at the base only . . . . . **Acacia** (p. 34)
- b. Filaments united into a tube in the proximal part . . . . . 15
- 15a. Leaves unipinnate . . . . . **Inga** Mill.
- b. Leaves bipinnate . . . . . 16
- 16a. Leaflets opposite or pinnae unifoliolate, proximal pair of leaflets rarely alternate, or leaflet unpaired . . . . . 17
- b. Leaflets alternate except perhaps the distal two; pinnae never unifoliolate . . . . 27
- 17a. Stipules spinescent, or branches armed with spines . . . . . 18
- b. Stipules not spinescent, in one case recurved and persisting; plants unarmed. . . 19
- 18a. Plants with ramous spines. Fruits falling apart in one-seeded segments. Seeds without aril . . . . . **Cathormion** (p. 143)
- b. Plants with stipular spines. Fruits dehiscing along the sutures. Seeds with fleshy, funicular aril . . . . . **Pithecellobium** (p. 154)
- 19a. Seeds with pleurogram . . . . . 20
- b. Seeds without pleurogram . . . . . 26
- 20a. Valves of fruit dehiscing elastically from the apex, recurving, margins thickened  
*Calliandra* Benth.
- b. Valves of fruit not dehiscing elastically from the apex, margins not or only slightly thickened. . . . . 21
- 21a. Flowers in glomerules or corymbs. . . . . 22
- b. Flowers in racemes or spikes . . . . . 25
- 22a. Flowers of the same inflorescence unit uniform . . . . . 23
- b. Flowers of the same inflorescence unit heteromorphic. . . . . 24
- 23a. Fruits woody, curved or curled, indehiscent. Seeds biserially arranged  
*Enterolobium* Mart.
- b. Fruits membranous-chartaceous, straight, dehiscent. Seeds uniserially arranged  
**Albizia** (p. 64)
- 24a. Fruit internally segmented. Seeds with an U-shaped areole . . . **Samanea** (p. 155)



- b. Fruit usually not segmented inside; if segmented, then the seeds with a horseshoe-shaped areole ..... **Albizia** (p. 64)
- 25a. Endocarp forming a closed envelope around each seed; seeds strongly flattened, circular ..... **Wallaceodendron** (p. 162)
- b. Endocarp not forming a closed envelope around each seed; seeds  $\pm$  flattened, ellipsoid ..... **Paraserianthes** (p. 148)
- 26a. Fruits usually spirally contorted, reddish orange especially on the inner surface with contrasting bluish black seeds; if straight, then turgid with disc-like or bitruncate seeds ..... **Archidendron** (p. 86)
- b. Fruits, where known, straight and flattened. Seeds strongly flattened, coin-like, with a narrow wing ..... **Archidendropsis** (p. 141)
- 27a. Leaflets petiolulate. Pods curved into a circle or contorted, reddish inside, dehiscent ..... **Pararchidendron** (p. 145)
- b. Leaflets sessile. Pods straight, not reddish inside, usually indehiscent or tardily dehiscent ..... **Serianthes** (p. 157)

### TRIBUS ACACIEAE

*Mimosoideae* tribus *Acacieae* Benth., Lond. J. Bot. 1 (1842) 318; Benth. & Hook. f., Gen. Pl. 1, 2 (1865) 594; Taub. in E. & P., Nat. Pflanzenfam. 3, 3 (1891) 108; Hutch., Gen. Fl. Pl. 1 (1964) 280; Vassal in Polhill & Raven, Adv. Leg. Syst. 1 (1981) 169.

Calyx with sepals valvate in bud, joined or free. Stamens 15—indefinite, filaments free or very shortly connate at base; anthers gland-tipped or not.

Distribution — Pantropical and warm temperate areas all over the world.

Note — Vassal (l.c.) recognized two genera, *Acacia* and *Faidherbia* A. Chev. The second genus, widespread in (sub)tropical Africa, is monotypic [*F. albida* (Del.) A. Chev.] and is based on *Acacia albida* Del.

### ACACIA

*Acacia* Mill., Gard. Dict., abridg. ed. (1754) 4; Willd., Sp. Pl. ed. 4, 4 (1806) 1049; Benth., Lond. J. Bot. 1 (1842) 318; Trans. Linn. Soc. 30 (1875) 444; Hutch., Gen. Fl. Pl. 1 (1964) 280; Vassal, Bull. Soc. Hist. Nat. Toulouse 108 (1972) 125; Isely, Mem. N.Y. Bot. Gard. 25 (1973) 10; Pedley, Contr. Qld. Herb. 18 (1975) 1; Austrobaileya 1 (2) (1978) 75; *ibid.* 1 (3) (1979) 235; J. Linn. Soc. Bot. 92 (1986) 219; Ross, Mem. Bot. Surv. S. Afr. 44 (1979) 1; Bothalia 13 (1981) 389; Nielsen, Opera Bot. 81 (1985) 7.

*Acacia* sect. *Phyllodineae* A.P. DC., Prod. 2 (1825) 448. — *Racosperma* Mart., Hort. Reg. Monac. Sem. (1835); Pedley, J. Linn. Soc. Bot. 92 (1986) 239.

*Senegalia* Raf., Sylva Tellur. (1838) 119; Pedley, J. Linn. Soc. Bot. 92 (1986) 238.

Armed or unarmed trees, shrubs or lianas. Stipules spinescent or not. *Leaves* bipinnate or modified to phyllodes by dilatation of the petiole and the proximal part of the rachis; extrafloral nectaries usually present on petiole and rachis; leaflets opposite (in Malesia), sessile to shortly stalked. *Inflorescences* consisting of pedunculate glomerules or spikes borne in axillary clusters or aggregated into terminal panicles. *Flowers* bisexual, or male and bisexual, tetra- or pentamerous, uniform. Calyx connate, valvate. Corolla connate, valvate. *Stamens* numerous (15 or more), free; anthers glandular or not. *Pods* extremely variable, dehiscent or indehiscent; endocarp not separating from the exocarp, not forming envelopes around each seed. *Seeds* usually elliptic to oblong,  $\pm$  flattened, with a hard black-brown testa with pleurogram, wingless; aril usually absent, but present in some phyllodinous species. — **Figs. 2, 7, 8.**

**Distribution** — Tropical and subtropical areas of the world, mainly in the Southern Hemisphere, Africa > 130 species, Madagascar c. 100, America c. 270, Australia and the Pacific area > 900, and Asia > 55 species, more than 1300 species in all; in Malesia 29 species.

**Habitat & Ecology** — Usually found in sunny, open habitats, e.g. along riversides and in clearings of the evergreen forest (several species of subg. *Aculeiferum*), in monsoon forest, and in savanna and dry scrub, where they often constitute a characteristic element of the vegetation (species of subg. *Acacia* and subg. *Phyllodineae*). The species have white or yellow, often fragrant flowers and are pollinated by bees. Generally they prefer well-drained soils, at low to medium altitudes, up to 800(–1200) m.

**Morphology** — The genus consists of trees, shrubs and climbers, the climbers being restricted to subg. *Aculeiferum*. Members of subg. *Acacia* in Africa display the characteristic flat-crowned habit and are deciduous during the dry season. Members of subg. *Aculeiferum* and subg. *Phyllodineae* are, as far as known, evergreen. In many species of the latter subgenus (sect. *Phyllodineae*) the mature leaves are reduced to xeromorphic phyllodes, formed by a dilatation of petiole and proximal part of leaf rachis. *Acacia concinna*, *A. megaladena*, *A. palawanensis*, *A. pennata*, *A. pluricapitata*, *A. pseudointsia*, and *A. sulitii*, all members of subg. *Aculeiferum*, display a plasticity in habit, being climbers in dense vegetation and erect shrubs (or trees) with scandent branches in open vegetation types. A similar potential for change of habit has been observed in the African *A. ataxacantha* (Ross 1981) and perhaps this can be regarded as necessary for forest-dwelling climbers to adapt to and exploit new habitats in savannas and woodland as the forest retreats, or vice versa.

**Leaves.** The leaves of the mature specimens of subg. *Aculeiferum* and subg. *Acacia* are bipinnate. In the major part of subg. *Phyllodineae* (excl. sections *Botrycephalae* and *Pulchellae*) the leaves are phyllodinous and look simple, being formed by dilation of the rachis and the petiole. The extrafloral nectaries, widespread in the *Mimosoideae*, can be observed in all three subgenera (except sect. *Filicinae*). In the phyllodinous species a nectary can often be observed as a slit or narrowly elliptic gland on the front margin of the phyllode close to the pulvinus. So-called 'reversion-shoots', i.e. shoots which develop bipinnate leaves, often with a compressed rachis and petiole, can be found in *A. melanoxylon*. A recent hypothesis on the evolution of phyllodes in *Acacia* is given by Pedley (1986).

*Stipules.* Stipular spines are found in all species of subg. *Acacia* and in only 15 species of subg. *Phyllodineae* (Pedley 1986). In subg. *Aculeiferum* the species are armed with prickles scattered along the internodes or paired, or ternate, just below the nodes (not in Malaysian species).

*Inflorescences.* Extensively reviewed by Pedley (1986). In subg. *Acacia* a ring of bracts is found on the peduncle; in *A. leucophloea* and *A. tomentosa* such a ring is situated in the middle of the peduncle (*Medibracteatae* Benth.), in *A. farnesiana* it is found just below the flowers (*Summibracteatae* Benth.); in subg. *Phyllodineae* and subg. *Aculeiferum* no ring of bracts is found, but in the latter a single bract is often present.

*Flowers.* The small flowers, which are aggregated in either pedunculate glomerules or spikes, do not furnish many characters for the distinction at species level. Pedley (1986) noted that the species of subg. *Aculeiferum* have a disc on which the stamens are inserted; this can also be seen in most Asian species of this subgenus. Discs are absent from the members of subg. *Acacia* and *Phyllodineae* and a few American species of subg. *Aculeiferum*. Most species of subg. *Aculeiferum* have the ovary placed on a gynophore (but e.g. in *A. vietnamensis* a gynophore is almost absent). The species of subg. *Acacia* and *Phyllodineae* have sessile or subsessile ovaries. The glandular appendages of the anthers, found in several genera of the *Mimoseae* but absent from the *Ingeae*, are found in most species of subg. *Aculeiferum* and in several species of subg. *Acacia* (e.g. in *A. leucophloea* and *A. tomentosa*), but are absent from other members of subg. *Acacia* (e.g. *A. farnesiana* and related American species) and from all species of subg. *Phyllodineae*. The stamens are free in all Asian and Australian *Acacia* species; a few African species of subg. *Acacia*, viz. *A. (Faidherbia) albida*, *A. ogadensis* and *A. eriocarpa* (Wickens 1969) have the stamens shortly connate at the base. Because of this character and for palynological reasons *A. albida* has been referred to a separate genus, *Faidherbia* A. Chev.

*Pods.* Robbertse (1976) found in a study of 39 South African species that species of subg. *Aculeiferum* could be distinguished from those of subg. *Acacia* by a fibre structure adjacent to the adaxial epidermis, consisting of both longitudinal and latitudinal fibres. The fibre layer of the species of subg. *Acacia* consists of longitudinal fibres only or it is absent. Fahn & Zohary (1955) found that 3 species of subg. *Phyllodineae* resembled species of subg. *Aculeiferum* in having fibres in two layers. Asian, Australian and American species need to be more studied in this aspect.

*Seeds.* In a recent account on the anatomy of the seed-coat of 123 *Acacia* species, Maumont (1990) found that subgenera *Aculeiferum* and *Phyllodineae* have a thinner seed-coat than subg. *Acacia*, that both the external and internal layers of hour-glass cells are more developed in subgenera *Aculeiferum* and *Phyllodineae*, and, moreover, that these have a mucilaginous layer on the Malpighian cells, a layer that is absent from subg. *Acacia*.

*Seedlings.* Vassal (1969, 1971, 1972, 1981) examined seedlings of c. 225 species. Six modes of succession of the leaves of seedlings were recognized: 1A: more than two pinnate leaves produced before the appearance of bipinnate leaves; 1B: two pinnate leaves before appearance of a bipinnate one; 2A: one pinnate leaf followed by a bipinnate one; 2B: one pinnate leaf followed by a phyllode; 2C: no pinnate or bipinnate leaves, first leaf a phyllode; 3: no pinnate leaf, first leaf bipinnate. Mode 1A was found only in subg. *Acacia* (except individual variation in *A. sclerosperma* F. Muell.); mode 3 was only found in sect.



*Spiciflorae* (subg. *Aculeiferum*); modes 1B and 2 appeared to be widespread throughout the genus, 1B and 2A predominate in subg. *Phyllodineae*; mode 2B was only reported within the variation in *A. confusa*. *Acacia oraria* from Timor (Fig. 7) has type 2B. The data above were mostly extracted from studies about African and Australian species; only a few Asian (Indian) species have been investigated. The Malesian species of subg. *Aculeiferum* have not yet been studied.

*References:* Fahn, A. & M. Zohary, *Phytomorphology* 5 (1955) 99–111. — Maumont, S., *Interêt taxonomique de l'histologie des téguments séminaux chez les Acacieae et les Ingeae (Leguminosae–Mimosoideae)*, Thesis Univ. Sabatier, Toulouse (1990) 1–184. — Pedley, L., *Bot. J. Linn. Soc.* 92 (1986) 219–254. — Robbertse, P.J., *Bothalia* 11 (1976) 481–489. — Ross, J.H., *Bothalia* 13 (1981) 392. — Vassal, J., *Bull. Soc. Hist. Nat. Toulouse* 105 (1969) 55–111, *ibid.* 106 (1971) 191–276; *ibid.* 108 (1972) 125–247; *Int. Group Study Mim. Bull.* 9 (1981) 50–55. — Wickens, G.E., *Kew Bull.* 23 (1969) 181–202.

**Taxonomy** — All modern classifications are based on the monograph of Benthams (1875), who noted (l.c.: 444): “This genus, which still appears to me to be naturally as well as definitely characterized by the stamens, neglecting the various forms assumed by the pod in ripening, remains the largest among *Mimoseae*, and, next to *Astragalus*, the largest among Leguminosae. I have not either been able, in this my third careful revision of the species, to divide it into sections founded upon any character derived from the flowers or fruits.” Since then the genus has not been revised on a worldwide basis. The works of Guinet, Pedley, Ross, and Vassal deal mainly with African and Australian species and give sufficient evidence for elevating the rank of series proposed by Benthams. Pedley (1986) proposed that the species of ser. *Vulgares* Benth. (= subg. *Aculeiferum* Vassal) should be referred to the genus *Senegalia* Raf. and that the species of subg. *Phyllodineae* (DC.) Seringe (= subg. *Heterophyllum* Vassal) should be referred to the genus *Racosperma* Mart., thus leaving the genus *Acacia* sensu stricto to comprise species with stipular spines, involuclate peduncles, and with colporate pollen with columellar exine structure.

The only characters investigated throughout the range of the genus *Acacia* were those of leaves, flowers, inflorescence, pollen and, to a lesser degree, seedlings. Some characters give indications about other affinities between the three subgenera and point toward a common ancestor. They are: the occurrence of stipular spines in 15 species of subgenera *Phyllodineae* and *Acacia*; the simply porate pollen grains and granular exines of subgenera *Aculeiferum* and *Phyllodineae*; the extra-Australian species *A. confusa* (Taiwan, Philippines), *A. kauaiensis* (Hawaii) and *A. simplex* (New Caledonia) share non-protein amino-acid patterns with members of subg. *Aculeiferum*; the flowers of subgenera *Acacia* and *Phyllodineae* have a sessile (or subsessile) ovary and lack a disc; most members of subg. *Aculeiferum* have glandular appendages on the anthers as have several species of subg. *Acacia*; glandular appendages are absent from all species of subg. *Phyllodineae*; the presence of internodal prickles in subg. *Aculeiferum* and the absence of such prickles in the two other subgenera.

The results of the studies by Guinet, Maumont, Pedley, and Vassal suggest that there are two different evolutionary lines within the original genus *Acacia*. One consists of *Acacia* and the other of the two subgenera *Aculeiferum* and *Phyllodineae*, with an interesting

convergence in the characters of fully or partly extra-Australian species of subg. *Phyllodineae* (e.g., *A. mangium*, *A. wetarensis*) to those of subg. *Aculeiferum*. Even affinities to both the tribes *Mimoseae* and *Ingeae* suggesting a biphyletic origin of the genus *Acacia* have been postulated. No evidence has been given that any of the three subgenera are more closely related to either genera of the *Mimoseae* or of the *Ingeae* than they are to each other. Therefore *Acacia* is treated as one genus here.

*References:* Bentham, G., Trans. Linn. Soc. 30 (1875) 444. — Pedley, L., Bot. J. Linn. Soc. 92 (1986) 219–254.

Palynology (see also p. 13–14) — Guinet (1969, 1981, 1986, 1990) examined the pollen of more than 1000 *Acacia* species. *Acacia* pollen grains are 8–48-celled polyads. Three major types that strongly correlate with the infrageneric subdivision could be distinguished:

- 1a. Infratectum columellar, monads distally with 3 colporate apertures (2 interangular), pseudocolpi absent, tectum smooth, with 0.5–1.5  $\mu\text{m}$  wide perforations, foot layer present: . . . . . type III (subg. *Acacia*)
- b. Infratectum granular, monads distally with 4 pores (all angular): . . . . . 2
- 2a. Tectum smooth, with narrow perforations (0.3–0.8  $\mu\text{m}$ ) or imperforate, pseudocolpi and foot layer absent: . . . . . type I (subg. *Aculeiferum*)
- b. Tectum usually suprareticulate (if not, pseudocolpi present), mostly perforate, pseudocolpi usually present, foot layer absent or very reduced: . . . . . type II (subg. *Phyllodineae*)

Pollen morphology clearly isolates subgenus *Acacia*. Therefore, Guinet (1990) proposed a subdivision into two groups, the first restricted to *Acacia*, the other including *Aculeiferum* and the *Phyllodineae*. Notwithstanding the well-known resemblances between pollen of *Acacieae* and *Ingeae*, pollen morphology suggests the separate derivation of both *Acacia* groups from the *Mimoseae*. This tribe would represent the polymorphic, older core of the subfamily *Mimosoideae*. Records of small 8-celled *Mimosa*-like polyads from the Upper Cretaceous corroborate the old age of the *Mimoseae*, but they still have to be verified (Muller 1981).

*References:* See Palynology *Mimosoideae* (p. 14).

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#### KEY TO THE SPECIES

- 1a. Leaves of mature plants bipinnate . . . . . 2
- b. Leaves apparently simple, being modified to phyllodes by flattening of petiole and rachis — Subg. PHYLLODINEAE (p. 57) . . . . . 38
- 2a. Stipules spinescent — Subg. ACACIA (p. 44) . . . . . 3
- b. Stipules not spinescent . . . . . 7
- 3a. Flowers in spikes. Pod slightly winged along the dorsal suture (Australia: Queensland, Northern Territory) . . . . . *A. sutherlandii* (F. Muell.) F. Muell.
- b. Flowers in glomerules. . . . . 4

- 4a. Involucel of bracts just below the glomerule and usually hidden by the lower flowers. Pods  $\pm$  circular in transverse section . . . . . **1. *A. farnesiana***
- b. Involucel of bracts at or below the middle of the peduncle. Pods flattened . . . . . 5
- 5a. Leaflets with lateral veins invisible . . . . . 6
- b. Leaflets with prominulous lateral veins beneath. Flowering glomerules light yellow to cream . . . . . **2. *A. leucophloea***
- 6a. Young branches finely pubescent, glabrescent. Flowering glomerules bright yellow. Pods  $\pm$  moniliform (India)
- A. nilotica* (L.) Willd. ex Del. subsp. *indica* (Benth.) Brenan
- b. Young branches densely yellow pubescent. Flowering glomerules yellowish white. Pods linear-falcate, not constricted between the seeds . . . . . **3. *A. tomentosa***
- 7a. Internodes armed with prickles — Subg. ACULEIFERUM (*p.* 47) . . . . . 8
- b. Internodes unarmed . . . . . 25
- 8a. Prickles paired, just below the stipules (India) . . . . . *A. catechu* (L. f.) Willd.
- b. Prickles in five rows along the internodes . . . . . 9
- 9a. Flowers in spikes. Stems ferrugineously hispid . . . . . **6. *A. donnaiensis***
- b. Flowers in pedunculate glomerules. Stems not hispid . . . . . 10
- 10a. Main vein of leaflets starting and running at or about the middle of the leaflet
- 10. *A. merrillii***
- b. Main vein of leaflets starting at or about the margin, up to 1/4 of the width of the leaflet at the acroscopic side . . . . . 11
- 11a. Lateral veins of leaflets forming a reticulate pattern beneath, i.e. at least with distinct anastomoses close to the basiscopic margin (but see 9. *A. megaladena*) . . . . . 12
- b. Lateral veins of leaflets not forming a reticulate pattern beneath . . . . . 17
- 12a. Leaflets membranous, usually with a wrinkled appearance when dry. Pod fleshy or fleshy-chartaceous, usually with wrinkled surfaces, breaking in one-seeded segments, or splitting along both sutures but then the valves held together by the internal septae . . . . . **5. *A. concinna***
- b. Leaflets chartaceous, without a wrinkled appearance when dry. Pods chartaceous, not segmented internally. . . . . 13
- 13a. Petiolar gland at or slightly above or below the middle of the petiole . . . . . 14
- b. Petiolar gland just above the basal pulvinus . . . . . 15
- 14a. Young stems often with a bluish waxy bloom. Lateral veins of leaflets usually distinctly reticulate. Pod 3.4–5 cm wide with prominulous veins across the seeds
- 15. *A. pseudointsia***
- b. Young stems without a bluish waxy bloom. Lateral veins of leaflets usually not reticulate, rarely anastomosing close to the basiscopic margin. Pod 2.1–2.7 cm wide, with inconspicuous veins . . . . . **9a. *A. megaladena* var. *megaladena***
- 15a. Leaflets shortly petiolulate; petiolules 0.2–0.4 mm; main vein starting at about 1/4 of the width of the leaflet at the acroscopic margin and running  $\pm$  parallel to the acroscopic margin . . . . . **8. *A. kostermansii***
- b. Leaflets sessile; main vein starting at the acroscopic margin, but not running parallel to the acroscopic margin . . . . . 16



- 16a. Ultimate parts of branches densely red-brown glandular puberulous with distinct alternating light brown and dark brown lines. Calyx narrowly campanulate, 1.6–2 mm long, eglandular. Stamens 2.8–3.5 mm . . . . . **7. A. kekapur**
- b. Ultimate parts of branches with yellowish glandular hairs, without distinct longitudinal lines. Calyx broadly cup-shaped to campanulate, 2–2.3 mm, with light-yellowish glands. Stamens 6.5 mm . . . . . **18. A. verheijenii**
- 17a. Petiolar and rachis glands stipitate or obconical; rachis glands numerous, usually at the junction of all pairs of pinnae, occasionally absent at the proximal 2 pairs . . . 18
- b. Petiolar and rachis glands sessile, circular-elliptic, patelliform, or saddle-shaped; rachis glands not numerous, usually present at the junction of the 1–5 distal pairs of pinnae only . . . . . 22
- 18a. Young branches with a dense cover of blackish glandular hairs. Main vein of leaflets running diagonally. Glomerules of flowers 7–8 mm in diameter; floral bracts lanceolate-spathulate. Pod chartaceous, continuous within, gradually narrowing into the stalk . . . . . **13. A. pluricapitata**
- b. Young branches with a  $\pm$  dense cover of reddish glandular hairs. Main vein of leaflets running parallel to the acroscopic margin for at least 1/4 of its length. Floral bracts ovate-oblong to obovate-oblong, or oblong-spathulate. Pod, where known, thinly woody, discontinuous within, seeds each in a separate compartment, abruptly narrowed into the stalk . . . . . 19
- 19a. Ultimate parts of branches without or with very few scattered non-glandular hairs. Glomerules of flowers c. 10–11 mm in diameter . . . . **14. A. pluriglandulosa**
- b. Ultimate parts of branches patently puberulous, setose or shortly fulvous tomentose to velutinous by non-glandular hairs . . . . . 20
- 20a. Ultimate parts of branches shortly fulvous tomentose to velutinous and with scattered, sessile, glandular hairs. Glomerules (7–)9–10 mm in diameter **4. A. borneensis**
- b. Ultimate parts of branches patently puberulous to setose and with a dense cover of reddish, sessile, glandular hairs . . . . . 21
- 21a. Stipules triangular, acute, c. 0.5–0.8 by 0.3–0.7 mm. Pinnae with up to 40 pairs of leaflets; leaflets angled to auriculate at the base, apex bent acroscopically. Glomerules c. 6 mm in diameter; calyx dotted by minute glands **17. A. tawitawiensis**
- b. Stipules ovate-lanceolate or lanceolate-falcate, c. 1.2–3 by 0.4–0.7 mm. Pinnae with up to 63 pairs of leaflets; leaflets asymmetrically truncate at the base, apex more or less straight. Glomerules 6.5–7.5 mm in diameter; calyx eglandular
- 16. A. sulitii**
- 22a. Petiolar gland at or above the middle of the petiole . . . . . 23
- b. Petiolar gland well below the middle of the petiole, usually placed in the lower fifth just above the basal pulvinus. . . . . 24
- 23a. Leaflets 1–1.5 mm wide, lateral veins prominuous to raised
- 9a. A. megaladena var. megaladena**
- b. Leaflets 0.3–0.8 mm wide, lateral veins prominuous to inconspicuous
- 9b. A. megaladena var. indochinensis**
- 24a. Apex of leaflets obtuse; lateral veins visible but hardly raised. Ovary glabrous. Pod with a narrow wing . . . . . **11. A. palawanensis**

- b. Apex of leaflets acute; lateral veins invisible to hardly visible. Ovary villous. Pod unwinged ..... **12. *A. pennata* subsp. *kerrii***
- 25a. Leaf-rachis and pinnae without extrafloral nectaries. Flowers pedicellate (W Indies)  
*A. glauca* (L.) Moench.
- b. Leaf-rachis with extrafloral nectaries. Flowers sessile (Australia) — Subg. PHYLLODINEAE sect. BOTRYCEPHALAE ..... 26
- 26a. Pinnae usually (5–)7–20 pairs; leaflets 20–50 pairs per pinna in well-developed leaves (if overlapping then keyed under both leads) ..... 27
- b. Pinnae number variable; if pinnae 3–5 pairs, then leaflets 15–20 pairs per pinna 30
- 27a. Branchlets acutely angular, glabrous; leaflets widely spaced, 5–10 mm (Australia: New South Wales, Victoria) ..... *A. decurrens* Willd.
- b. Branchlets not acute angular, puberulous; leaflets crowded, 2–4 mm ..... 28
- 28a. Pinnae 6–10 pairs; leaflets 18–30 pairs per pinna; puberulous on both surfaces (Australia: Queensland, New South Wales)  
*A. deanei* (R.T. Baker) Welch, Coombs & McGlynn
- b. Pinnae 7–20 pairs; leaflets 20–50 pairs per pinna, usually glabrous above . . . 29
- 29a. Glands present between the rachis nodes; leaflets 1.8–2.2(–2.5) mm, apex rounded. Pod c. 6 mm wide, puberulous, glabrescent, not glaucous (Australia: New South Wales, Victoria) ..... *A. mearnsii* De Wild.
- b. Leaf-rachis internodes eglandular; leaflets (2–)2.6–3.5 mm, apex often subacute. Pod 7–9(–12) mm wide, glabrous, usually glaucous (Australia: New South Wales, Victoria, Tasmania) ..... *A. dealbata* Link
- 30a. Larger leaflets 20–50 mm long (Australia: New South Wales)  
*A. elata* A. Cunn. ex Benth.
- b. Leaflets all or for the greater part shorter than 20 mm ..... 31
- 31a. Glands present between the rachis nodes; leaf-rachis with appressed indumentum (Australia: Queensland, New South Wales)  
*A. deanei* (R.T. Baker) Welch, Coombs & McGlynn
- b. Leaf-rachis internodes eglandular; leaf rachises either with patent indumentum or glabrous ..... 32
- 32a. Branchlets and leaf-rachises with patent indumentum (glabrescent in the Australian species *A. spectabilis* A. Cunn. ex Benth.) ..... 33
- b. Branchlets and leaf-rachises glabrous ..... 35
- 33a. Leaflets 12–15 pairs per pinna (Australia: New South Wales)  
*A. baileyana* F. Muell.
- b. Leaflets 4–6(–10) pairs per pinna ..... 34
- 34a. Pinnae 2–3(–4) pairs; rachis 0.4–1.5 cm long; leaflets 4–8 by (1.5–)2–3 mm (Australia: Queensland, New South Wales) ..... *A. polybotrya* Benth.
- b. Pinnae 3–5(–7) pairs; rachis 2–7(–9.5) cm long; leaflets 6–11(–13) by 2.5–5 mm (Australia: Queensland, New South Wales) . . . *A. spectabilis* A. Cunn. ex Benth.
- 35a. Leaflets 10–15 pairs per pinna ..... 36
- b. Leaflets 4–6(–10) pairs per pinna ..... 37
- 36a. Leaves sessile; leaflets 3–8 mm. Pod 0.9–1.2 cm wide (Australia: New South Wales) ..... *A. baileyana* F. Muell.

- b. Leaves petioled; leaflets 9–17 mm. Pod 0.7 cm wide (Australia: Queensland, New South Wales) . . . . . *A. pruinosa* A. Cunn. ex Benth.
- 37a. Pinnae 2–3(–4) pairs; rachis 0.4–1.5 cm long; leaflets 4–8 by (1.5–)2–3 mm (Australia: Queensland, New South Wales) . . . . . *A. polybotrya* Benth.
- b. Pinnae 3–5(–7) pairs; rachis 2–7(–9.5) cm long; leaflets 6–11(–13) by 2.5–5 mm (Australia: Queensland, New South Wales) . . . . . *A. spectabilis* A. Cunn. ex Benth.
- 38a. Flowers in spikes — Subg. PHYLLODINEAE sect. JULIFLORAE (p. 57). . . . . 39
- b. Flowers in glomerules. . . . . 50
- 39a. Phyllodes completely covered with appressed silvery grey pubescence (Australia: Queensland) . . . . . *A. holosericea* A. Cunn. ex G. Don
- b. Phyllodes without silvery grey pubescence . . . . . 40
- 40a. Flowers all or for the greater part tetramerous. Pods linear, straight to curved, 0.3–0.6 cm wide . . . . . 41
- b. Flowers pentamerous . . . . . 42
- 41a. Foliar gland not prominent. Phyllodes straight, 5–10 by (0.2–)0.4–1 cm. Spikes sparsiflorous. Pod c. 13 by 0.3 cm (Australia: Queensland, New South Wales, Victoria) . . . . . *A. floribunda* (Vent.) Willd.
- b. Foliar gland prominent. Phyllodes variable, 4–16 by 0.3–2.5 cm. Spikes loose and interrupted. Pod 2.5–15 by 0.3–2.5 cm (Australia: extratropical areas of E Australia, Tasmania) . . . . . *A. longifolia* (Andr.) Willd.
- 42a. Phyllodes without anastomosing secondary longitudinal veins . . . . . 43
- b. Phyllodes at least with a few anastomosing secondary longitudinal veins . . . . . 45
- 43a. Spikes sessile with hirsute rachis. Pods papery, c. 1 cm wide
- 24. *A. pubirhachis***
- b. Spikes shortly pediculate, not hirsute. Pods coriaceous to woody . . . . . 44
- 44a. Pulvinus (4–)5–20 mm long; phyllodes with yellowish veins and margin. Pods woody, obovoid-oblong, with transverse but hardly reticulate veins, 5 by 2–3.5 cm
- 21. *A. crassicarpa***
- b. Pulvinus 4–7 mm long; phyllodes without yellowish veins and margins. Pods coriaceous to subwoody, with transverse anastomosing veins, oblong, 8 by (1–)2 cm
- 19. *A. aulacocarpa***
- 45a. Spikes on peduncles 0.5–1 cm long. Phyllodes 9–22 times as long as wide
- 25. *A. spirorbis***
- b. Spikes on peduncles up to 0.5 cm long. Phyllodes often less than 20 times as long as wide. . . . . 46
- 46a. Branchlets with indumentum of appressed hairs (Australia: Queensland)
- A. longispicata* Benth.
- b. Branchlets scurfy or glabrous . . . . . 47
- 47a. Branchlets stout and acutely angular. Phyllodes with 3–5 prominent longitudinal veins running from the base, and with secondary veins forming a fine reticulum. Pods linear, coiled and turgid. Flowers rusty, cream, greenish, or pale yellow
- 23. *A. mangium***
- b. Branchlets slender, not acutely angular. Flowers, where known, bright golden yellow. . . . . 48



- 48a. Secondary veins of phyllodes forming a delicate reticulum; phyllodes rather short, 5–12 by 1.4–3.2 cm ..... **26. *A. wetarensis***
- b. Secondary veins with spaced anastomoses; phyllodes longer, 10–21(–26) by 1–2.6 (–3) cm ..... 49
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**20. *A. auriculiformis***
- b. Pods linear, somewhat coiled, with longitudinal placed seeds. Pulvinus (3–)5–10 mm long; phyllodes with 3 yellowish, longitudinal veins. Spikes moderately dense  
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- b. Glomerules arranged in racemes or panicles; if glomerules less than 15 mm long, then enclosed by imbricate bracts before development. Phyllodes with a single main vein ..... 52
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- b. Branchlets glabrous. Phyllodes deltoid or semi-orbicular, very unequal-sided, broader on the distal side, glabrous; 0.8–2.5 by 0.5–2 cm (Australia)  
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*A. suaveolens* (Sm.) Willd.
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*A. pycnantha* Benth.
- b. Branchlets at the top angularly ribbed. Phyllodes straight to slightly curved, 8–12 by 0.7–0.8 cm. Glomerules 20–30-flowered, less than 1 cm in diameter (Australia)  
*A. falcata* Willd.

- 58a. Branchlets and base of phyllodes with conspicuous stellate hairs (Australia: Queensland) . . . . . *A. flavescens* A. Cunn. ex Benth.  
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 29. *A. simsii*

### Subgenus *Acacia*

Trees or shrubs. Stipules spinescent; internodes unarmed. Leaves of mature plants bipinnate; petiole and rachis with extrafloral nectaries.

Distribution — Pantropical; most diversified in Africa (c. 80 species) and America (more than 20 species); few in Asia (c. 10) and in Australia (3 or 4); in *Malesia* 3 species.

Cytology — Chromosomes  $2n = 26, 52, 104$  [Vassal, Bull. Soc. Hist. Nat. Toulouse 105 (1969) 55]; polyploidy frequent.

1. *Acacia farnesiana* (L.) Willd., Sp. Pl. ed. 4, 4 (1806) 1083; DC., Prod. 2 (1825) 461; Backer & Bakh. f., Fl. Java 1 (1963) 556; Ross, Bothalia 11 (1975) 471; Pedley, Austro-baileya 1 (3) (1979) 308; Ross, Mem. Bot. Surv. S. Afr. 44 (1979) 102, f. 80; Verdc., Manual New Guin. Legum. (1979) 168; Ross, Bothalia 13 (3/4) (1981) 407; Nielsen, Fl. Camb. Laos Vietnam 19 (1981) 44, pl. 6: 1–8; Fl. Nouv.-Caléd. et Dépend. 12 (1983) 29. — *Mimosa farnesiana* L., Sp. Pl. 1 (1753) 521; Blanco, Fl. Filip. 1 (1838) 729. — *Vachellia farnesiana* (L.) Wight & Arn., Prod. 1 (1834) 272; Wight, Ic. Pl. 1 (1840) t. 300. — *Farnesia odora* Gasp., Descr. Nouv. Gén. Legum. (1836). — *Popanax farnesiana* (L.) Raf., Sylva Tellur. (1838) 118.

Branched shrub or rarely a small tree to 4 m high. Branchlets terete, greyish brown, glabrous, with prominent lenticels. Stipules spinescent, up to 5 cm long. Leaves, lateral shoots and peduncles often placed on short-shoots. *Leaves*: rachis 4–6 cm, petiole 1–1.3 cm; gland in the distal half of the petiole, circular, sessile, often raised, c. 0.3

mm in diameter; pinnae 2–8 pairs, 1.5–3 cm, eglandular; leaflets 10–21 pairs per pinna, opposite, sessile, linear-oblong, 2–8 by 0.8–1.8 mm; base truncate, apex asymmetrically acute and mucronate, both surfaces glabrous; main vein excen-trical, not parallel to the acroscopic margin, lateral veins raised and prominent beneath. *Inflorescences* consisting of pedunculate glomerules, in groups of 1–7 in the upper leaf-axils; peduncle c. 0.8–3.5 cm, involucre of bracts at the summit, hidden by the flowers. *Flowers* sessile, golden-yellow, fragrant, pentamerous. Calyx c. 1.3 mm; tube gla-brous, teeth triangular, acute, 0.2 mm, glabrous except for the exterior of the apex. Corolla c. 2.5 mm; tube glabrous, lobes 5, elliptic, acute, c. 0.5 mm, scarcely puberulous at the apex. *Stamens* num-erous, 4–5.5 mm, anthers glandless. Ovary sub-sessile, c. 1.5 mm, densely puberulous. *Pod* dark brown to black, straight or mostly slightly curved, terete in cross section, rigidly chartaceous, gla-brous, indehiscent, not bullate over the seeds, veins obliquely longitudinal, with some prominulous anastomoses, 4–7.5 by 1–2 cm; seeds obliquely transverse, separated from each other by pith. *Seeds* elliptic, 6–8 by 4–5.5 mm, only slightly

flattened; areole elliptic, 6.5–7 by 4 mm, open towards the hilum.

**Distribution** – Pantropical, probably originating in the northern part of tropical America, where the closest related species are found; now introduced to all tropical and subtropical regions. Burkill [Dict. 1 (1935) 20] stated that it was introduced to the Philippines by the Spaniards from Mexico. Recorded throughout *Malesia*.

**Habitat & Ecology** – Naturalized, scattered in plains, brushwood and waste-grounds; altitude sea-level up to 400 m, cultivated up to 1200 m. Flowering throughout the year.

**Uses** – Exudes a gum; flowers used for perfume, pods for tanning; the bark has medicinal properties as an astringent.

**2. *Acacia leucophloea* (Roxb.) Willd., Sp. Pl. ed. 4, 4 (1806) 1083; Backer & Bakh. f., Fl. Java 1 (1963) 556; Nielsen, Adansonia sér. 2, 19 (3) (1980) 345; Fl. Camb. Laos Vietnam 19 (1981) 46, pl. 6: 9–15; Fl. Thailand 4 (2) (1986) 160. — *Mimosa leucophloea* Roxb., Pl. Corom. 2 (1800) 27, t. 150; Fl. Ind. ed. 2, 2 (1832) 558.**

*Acacia arcuata* Decne., Herb. Timor Descr. (1835) 133; Miq., Fl. Ind. Bat. 1 (1855) 6.

*Acacia melanochaetes* Zoll., Nat. Geneesk. Arch. Ned. Ind. 3 (1846) 72, 80. — *Acacia leucophloea* (Roxb.) Willd. var. *melanochaetes* Miq., Fl. Ind. Bat. 1 (1855) 9.

*Delaportea microphylla* Gagnep., Bull. Soc. Bot. Fr. 99 (1852) 46.

*Delaportea ferox* Gagnep., Bull. Soc. Bot. Fr. 99 (1852) 47.

Deciduous tree to 35 m high, stem diameter 35–100 cm; crown spreading. Branchlets angular in the distal parts, tomentose to scarcely puberulous, glabrescent. Stipules spinescent, straight. Leaves and inflorescences most often on short-shoots. **Leaves:** rachis 3.5–10 cm, petiole 0.6–2 cm, with one gland just below the junction of the proximal pair of pinnae, circular to narrowly elliptic, with raised margins, 0.5–1 mm long, glands on rachis below the junctions of all pairs of pinnae or at the distal pair only; pinnae (4–)6–13 pairs, (0.5–)3–4.3 cm, eglandular; leaflets 6–25 pairs per pinna, opposite, sessile, linear to subfalcate, 3–12 by 0.5–2(–2.8) mm, base asymmetrically truncate, apex asymmetrically acute, both surfaces glabrous, margins often slightly ciliate; main vein  $\pm$  diagonal, starting from the areoscopic margin, lateral veins prominent beneath, not anastomosing, inconspicuous above. **Inflorescences** consisting

of pedunculate glomerules aggregated into terminal or axillar panicles up to c. 30 cm, tomentose or woolly; peduncles of glomerules often in clusters of four, 0.4–1.3 cm, involucre bracts in the middle of the peduncle. **Flowers** sessile, light yellow to cream, pentamerous. Calyx 0.8–1.2 mm, distal part of tube and lobes puberulous; lobes triangular, acute, 0.1 mm. Corolla 1.2–2 mm, glabrous; lobes broadly oblong-ovate, acute, 0.3 mm. **Stamens** 15–20, 2.8 mm long, anthers with a gland at the apex of the connective. Ovary subsessile, 0.9 mm, minutely puberulous at the top. **Pod** olive-green to dark brown, linear, or strap-shaped, often falcate, thinly woody, dehiscent, puberulous to tomentose and glandular when young, glabrescent, internally segmented between the seeds, 7–14 by 0.8–1 cm, with the seeds obliquely held. **Seeds** variable, orbicular, broadly elliptic or trapezoid, 4.5–6.5 by 3–5 mm,  $\pm$  flattened; areole c. 2 by 1 mm, open towards the hilum; funicle thin and contorted.

**Distribution** – India, Burma, Thailand, S Vietnam; in *Malesia*: Java, Madura, Bali, Timor. — Fig. 1.

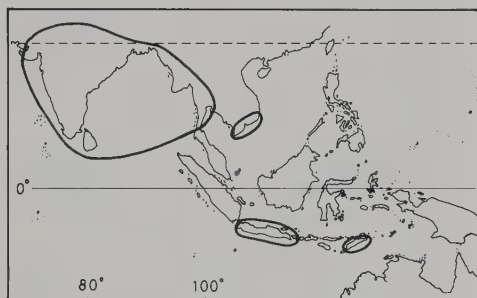


Fig. 1. Range of *Acacia leucophloea* (Roxb.) Willd.

**Habitat & Ecology** – Savanna, scrub, dry sclerophyll forest, teak-forest and brushwood; on well-drained, often chalky soil; altitude 50–750 m. Fl. Jan.–June, fr. Apr.–July.

**Field notes** – The trees often have a spreading crown, with the inflorescences forming a fine carpet on the top; bark of trunk brown, peeling off, yellow underneath; trunk often with thorny suckers.

**Uses** – Bark tanniferous, the wood very hard and durable.

**Note** – The indumentum of branchlets and calyx of Malesian specimens tends to be scarcer than that of continental material.



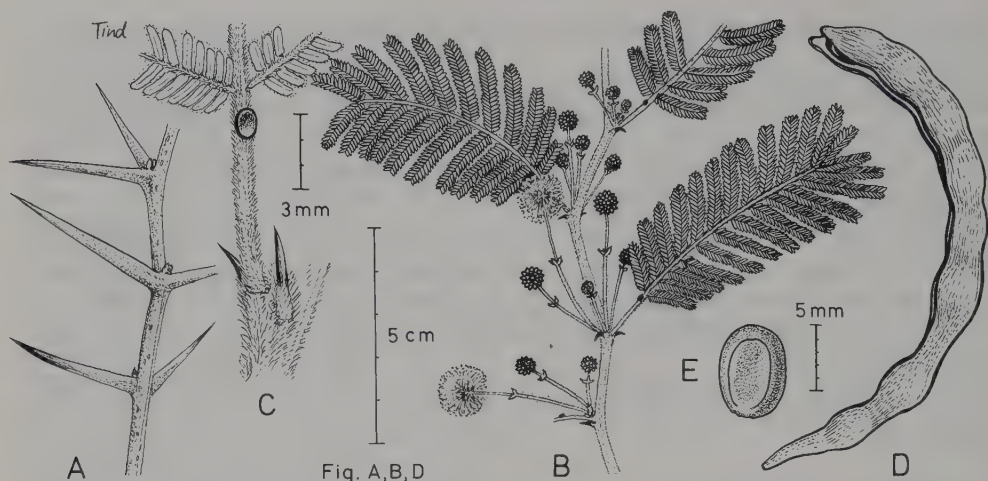


Fig. 2. *Acacia tomentosa* Willd. A. Nude branch with stipular spines; B. habit; C. juvenile stipular spines and leaf base with nectary; D. pod; E. seed (A: Lörzing 969; B, C: Docters van Leeuwen-Reijnvaan 109; D, E: Boersma s.n.).

**3. *Acacia tomentosa* Willd.**, Sp. Pl. ed. 4, 4 (1806) 1087; DC., Prod. 2 (1825) 462; Nielsen, Fl. Camb. Laos Vietnam 19 (1981) 49; Fl. Thailand 4 (2) (1986) 161. — *Mimosa tomentosa* (Willd.) Rottler, Nov. Act. Nat. Cur. (1803) 208; Roxb., Fl. Ind. ed. 2, 2 (1832) 558.

*Acacia chrysocoma* Miq., Fl. Ind. Bat. 1 (1855) 6. — *Acacia tomentosa* Willd. var. *chrysocoma* (Miq.) Backer, Voorl. Schoolfl. (1908) 107; Backer & Bakh. f., Fl. Java 1 (1963) 556.

Deciduous shrub or tree with umbelliform crown, to 10(–15) m high, stem up to 50 cm in diameter. Branchlets angular and these, as well as young leaves, inflorescences and pods densely yellowish tomentose or woolly. Stipules spinescent, up to 4.5 cm long, straight. Leaves and inflorescences on short-shoots. *Leaves*: rachis (2.5–)3–9 cm, petiole 0.6–1 cm with one gland just below the junction of the proximal pair of pinnae, elliptic, flat to cushion-shaped, 1–2.5 mm; gland(s) on the rachis at the junctions of the 1 or 2 distal pairs of pinnae, circular, flattened, 0.8 mm in diameter; pinnae (7–)12–25 pairs, 0.9–2.5 cm; leaflets 12–50 pairs per pinna, opposite, sessile, chartaceous, linear, 1–4 by 0.4–1 mm; base asymmetrical, truncate/cuneate, apex obtuse with slightly scarious margin, scarcely to densely puberulous with long appressed hairs on lower surface and margins and sometimes on upper surface, or leaf-

lets subglabrous with ciliate margins only; main vein excentric, parallel to both margins; lateral veins invisible. *Inflorescences* consisting of pedunculate glomerules, 1–7, in the axils of the upper leaves, peduncles to c. 2.5 cm long, involucrel of bracts 0.7–1.4 cm above the base, in the lower half of the peduncle. *Flowers* sessile, white or yellowish white, tetra- or pentamerous. Calyx 0.9–1.2 mm; tube glabrous except for the distal part and the teeth, which are puberulous to tomentose; teeth triangular, acute, 0.1–0.2 mm. Corolla 2.8–3.5 mm, glabrous, lobes ovate or ovate-elliptic, acute, 0.5–1 mm. *Stamens* numerous, c. 5 mm long, anthers with a stipitate caducous gland at the apex of the connective. Ovary sessile, 0.8–1 mm, glabrous. *Pod* dark brown, with a yellowish in-

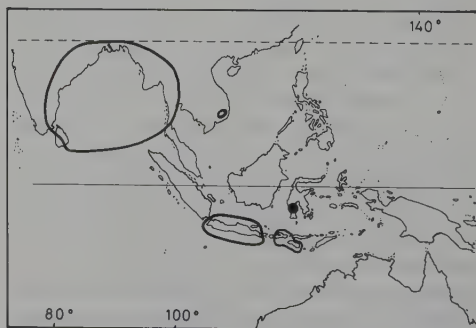


Fig. 3. Range of *Acacia tomentosa* Willd.

dundentum especially when young, linear-falcate, flattened, slightly swollen across the seeds, coriaceous, 9–18 by 0.8–1 cm, with prominulous,  $\pm$  parallel longitudinal veins, dehiscing along both sutures; seeds held longitudinally in the pod pointing towards the base. *Seeds* elliptic to oblong, flattened, 6.5–9 by 4–5.5 cm; areole elliptic, up to 7 by 2.8 mm, open towards the hilum. — **Fig. 2.**

**Distribution** — Sri Lanka, S India, Bengal, Burma, Thailand, Vietnam; in *Malesia*: Java, Madura, Sumba, Sumbawa, Celebes. — **Fig. 3.**

**Habitat & Ecology** — Savanna, teak-forest, brushwood, areas close to the beach, planted along roads and on dikelets between ricefields; altitude sea-level up to 500 m. Fl. Oct.–June.

**Field note** — Bark dark brown and irregularly fissured.

**Uses** — Used for firewood.

**Note** — The yellowish indumentum which was used to characterize var. *chrysocoma* (Miq.) Backer is found in the type-collection (from India) too, and the variety is therefore not recognized.

### Subgenus *Aculeiferum*

*Acacia* subg. *Aculeiferum* Vassal, Bull. Soc. Hist. Nat. Toulouse 108 (1972) 138.

*Senegalia* Raf., Sylva Tellur. (1838) 119; Pedley, J. Linn. Soc. Bot. 92 (1986) 238.

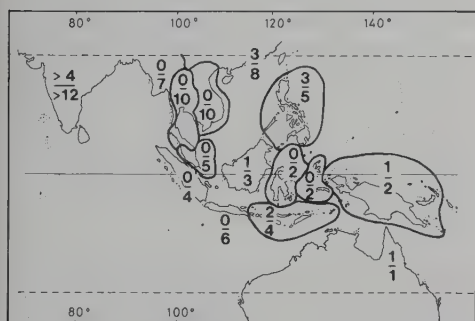
*Acacia* ser. *Vulgares* Benth., Lond. J. Bot. 1 (1842) 322; in Miq., Fl. Ind. Bat. 1 (1855) 1, 9 (as *Acacia* § 3 *Vulgares*); Trans. Linn. Soc. 30 (1875) 516.

**Trees**, shrubs, scandent shrubs or lianas. Stipules not spinescent; internodes armed with prickles. Leaves of mature plants bipinnate; petiole and rachis with extrafloral nectaries.

**Distribution** — Pantropical, most diversified in Africa (57 species), tropical America (more than 40), Australia (1), and Asia (c. 35); in *Malesia* 15 species, of which 9 are endemic. — **Fig. 4.**

**Cytology** — Chromosomes  $2n = 26$ , most frequently diploids.

**Note** — The Malesian species belong to sect. *Monacantha* subsect. *Phanerocotylae* ser. *Gerontogae* according to the classification proposed by Vassal (l.c.: 148–154).



**Fig. 4.** Range of *Acacia* subg. *Aculeiferum* Vassal in Asia and Australia. The figures above the hyphen indicate the number of endemic species, those below the hyphen indicate the total number of species.

#### **4. *Acacia borneensis* Nielsen, Opera Bot. 81 (1985) 20, f. 8, 9: 7–13.**

Woody climber, 10 m high or more; girth up to 7 cm or more. Young branches terete, armed with c. 1.5 mm long recurved prickles, alternating longitudinal lines not conspicuous, young branches and inflorescence shortly tomentose to velutinous, fulvous, with scattered, sessile, reddish glandular hairs below the indumentum. Stipules linear-filiform, caducous, 2 by 0.3–0.5 mm, scattered bristly puberulous. *Leaves* evenly distributed along the stems; rachis 7–15 cm, patently puberulous, petiole 1.5–3 mm, with a gland 0.6–1.3 cm above the base in the lower half of the petiole, obconical to cylindrical, often concave, 0.1–1 mm in diameter, narrow, with obconical glands on the rachis at the junctions of all pairs of pinnae or glands sometimes absent at the proximal 1–7 pairs; pinnae 12–18 pairs, 1.5–4.5 cm; leaflets 25–51 pairs per pinna, opposite, sessile, chartaceous, oblong-linear,

2.5–4.5 by 0.4–0.8 mm, base asymmetrically truncate, apex acute, sometimes slightly bent, both surfaces glabrous but margin of basiscopic side of base often ciliate; main vein starting at the front margin and  $\pm$  parallel with margin for 1/4 to 1/3 of its length; lateral veins either inconspicuous or prominulous. *Inflorescence* consisting of pedunculate glomerules of subsessile flowers, axillary or aggregated into terminal panicles, glomerules (7–) 9–10 mm in diameter, floral bracts ovate or oblong to spatulate, not projecting beyond the flowerbuds. *Flowers* yellowish-white, bisexual, pentamerous. Calyx 1.5–2.1 mm, glabrous, teeth irregular, ovate or triangular-ovate, acute, 0.3–0.6 mm. Corolla (1.9–)2–2.7 mm, glabrous; lobes triangular-ovate to narrowly ovate, acute, 0.5–0.8 mm. *Stamens* 4.5–5.5 mm. Ovary c. 1 mm, villous, stipe 0.8–1 mm. *Pod* chestnut brown, linear-oblong, flattened, with very sinuate margins, rather abruptly narrowed into an inconspicuous, 0.3–0.5 cm long stalk, 8–12 by 1–2.2 cm, valves thin over the seeds, subwoody in between, glabrous or with a few scattered dark glandular hairs close to the margin, not bullate over the seeds, with inconspicuous veins, pod internally discontinuous between the seeds. *Seeds* dark brown, broadly oblong, flattened, c. 9.5–10.5 by 6–6.2 mm; areole oblong, (6.5–)8 by 2.5 mm, pleurogram parallel to the margins, open towards the hilum.

*Distribution* – *Malesia*: Borneo (Sabah, Kalimantan).

*Habitat & Ecology* – Primary and secondary rain forest, forest edges on riverbanks, roadsides, logged-over areas; altitude 0–50 m. Flowering and fruiting throughout the year.

**5. *Acacia concinna*** (Willd.) DC., Prod. 2 (1825) 464; Verdc., Kew Bull. 32 (1978) 471; Manual New Guin. Legum. (1979) 164; Nielsen, Adansonia sér. 2, 19 (3) (1980) 348; Fl. Camb. Laos Vietnam 19 (1981) 58, pl. 9: 9–16; Opera Bot. 81 (1985) 12; Fl. Thailand 4 (2) (1985) 169. — *Mimosa concinna* Willd., Sp. Pl. ed. 4, 4 (1806) 1039. — *Acacia rugata* Buch.-Ham. ex Benth. var. *concinna* (Willd.) Kurz, J. As. Soc. Beng. 45, 2 (1876) 297.

*Nugae sylvanum minima* Rumph., Herb. Amb. 5 (1747) 95, t. 49, f. 2.

*Mimosa rugata* Lam., Enc. Méth. Bot. 1 (1783) 20; DC., Prod. 2 (1825) 431. — *Acacia rugata* (Lam.) Buch.-Ham. ex Voigt, Hort. Suburb. Calc. (1845) 263; Merr., Philipp. J. Sci., Bot. 5 (1910) 28; Backer & Bakh. f., Fl. Java 1 (1963) 556.

*Mimosa sinuata* Lour., Fl. Cochinch. (1790) 653; ed. Willd. (1793) 802. — *Acacia sinuata* (Lour.)

Merr., Trans. Amer. Philos. Soc. 24 (1935) 186.

*Acacia polycephala* DC., Prod. 2 (1825) 2; Benth., Lond. J. Bot. 1 (1842) 514.

*Guilandina microphylla* DC., Prod. 2 (1825) 480.

?*Mimosa tenuifolia* Blanco, Fl. Filip. (1837) 739; ed. 2 (1845) 510; ed. 3, 3 (1879) 141, t. 374; non L. (1753).

*Acacia rugata* Buch.-Ham. ex Benth., Lond. J. Bot. 1 (1842) 514. — *Acacia concinna* (Willd.) DC.

var. *rugata* (Buch.-Ham. ex Benth.) Baker in Hook. f., Fl. Br. India 2 (1878) 297.

*Acacia philippinarum* Benth., Lond. J. Bot. 1 (1842) 514; Merr., Enum. Philipp. 2 (1923) 249, p.p.

*Acacia hooperiana* Zipp. ex Miq., Fl. Ind. Bat. 1 (1855) 10, 11, incl. var.  $\gamma$  *subcuneata* Miq. and var.  $\beta$  *glabriuscula* Miq.

*Acacia poilanei* Gagnep., Bull. Soc. Bot. Fr. 99 (1952) 47.

*Acacia quisumbingii* Merr., Philipp. J. Sc. 82 (1953) 316.

*Acacia pseudointsia* auct. non Miq.: Prain, J. As. Soc. Beng. 66, 2 (1897) 511, p.p., quoad *Ridley* 3631; Ridley, Fl. Mal. Pen. 1 (1923) 657, p.p.

*Acacia pennata* auct. non (L.) Willd.: Merr., Philipp. J. Sc., Bot. 5 (1910) 29, p.p.; Enum. Philipp. 2 (1923) 249, p.p., quoad syn. *Mimosa tenuifolia* Blanco, non L.

Erect spreading or scrambling shrub or woody climber, 7.5–18(–30) m high, with several stems of up to 10 cm in diameter, bearing straggling branches. Branchlets terete, armed by 5 rows of up to c. 3 mm long prickles, greyish, with numerous transverse, light lenticels, without alternating longitudinal lines, ultimate parts of branchlets velutinous to tomentose, glabrescent, with scattered light yellowish glandular hairs or without glandular hairs. Stipules cordate, 3–8 by 1.5–6 mm, often slightly caudate, woolly or slightly puberulous, caducous. *Leaves* evenly scattered along the stem; rachis 6–16(–22) cm, pubescent or glabrous,  $\pm$  armed by abaxial prickles, petiole (1.2–)1.5–5.2 (–6) cm, with a gland 0.4–2.7 cm above the base, in the lower half of the petiole, elliptic to circular in outline, usually raised, often concave, 0.8–15 (–2) mm in diameter and with additional glands on the rachis at the junctions of the 1–3 distal pairs of pinnae; pinnae 4–11 pairs, puberulous, (1.5–) 2–9 cm, with minute glands at the junctions of the 1–3 distal pairs of leaflets; leaflets 10–37 pairs per pinna, opposite, sessile, membranous, often wrinkled in dried condition,  $\pm$  narrowly oblong,



curved acroscopically, 3.5–11.5(–13.5) by 0.8–3 (–4.8) mm, base asymmetrically truncate, apex rounded, asymmetric, mucronate or nearly hooked; both surfaces glabrous to sericeous by semipatent hairs, margin  $\pm$  ciliate; main vein starting at the front margin, diagonal with two to several accessory veins issuing from the base, these and the secondary veins forming a  $\pm$  raised, reticulate pattern beneath. *Inflorescence* consisting of pedunculate glomerules aggregated into short racemes or rarely in terminal panicles up to 20 cm, peduncles clustered in groups of up to four; glomerules 7–12 mm in diameter, floral bracts spatulate, not projecting beyond the flowers in bud. *Flowers* sessile, bisexual, pentamerous, white or cream, buds dark red. Calyx red, 2–3.2 mm; tube glabrous to puberulous; teeth 0.1–0.5(–0.9) mm, glabrous to puberulous. Corolla (2.3–)3–4 mm; tube glabrous; lobes 0.5–1 mm, glabrous except sometimes for extreme apex. *Stamens* 3.5–5.5 mm. Ovary 0.8–1.5 mm, glabrous to sericeous, stipe 1–1.5 mm. *Pod* brown to black, oblong, 4.5–15 by 1.5–2 cm, valves fleshy, often with sinuate margins, and constricted, usually very wrinkled when dry, glabrous, with inconspicuous veins, internally with very thin and fragile septae between the seeds, either falling apart in one-seeded segments, or dehiscing along both sutures. *Seeds* variable, elliptic, oblong or orbicular, slightly flattened, 6.5–11 by 4.5–8 mm; areole elliptic to oblong, 5–10 by 3–6.9 mm, pleurogram parallel to the margin and open towards the micropyle.

*Distribution* – Tropical Asia; in *Malesia*: Malaya, Singapore, Sumatra (1 coll.), Java, Philippines, Celebes, Sumba, Flores, Banda, Ambon, Kai Is., Papua New Guinea.

*Habitat & Ecology* – Rain forest, disturbed forest, open grassland, fields, creek sides, in open areas often a sprawling shrub; also recorded from limestone; altitude 50–1050 m. Fl. throughout the year; fr. Feb.–Mar.

*Uses* – The acid fruits are sometimes used in the Philippine cooking.

*Note* – Probably not indigenous to E Malesia. For a full synonymy, see Nielsen (1980: 348).

**6. *Acacia donnaiensis* Gagnep., Not. Syst. 2 (1911) 114; Fl. Gén. Indo-Chine 42 (1913) 84; Nielsen, Adansonia sér. 2, 19 (3) (1980) 349; Fl. Camb. Laos Vietnam 19 (1981) 50, pl. 7: 1–9; Opera Bot. 81 (1985) 9, f. 1.**

Scandent shrub or woody climber, 3 m high or more. Branchlets terete, armed by 5 rows of c. 1 mm long recurved prickles, placed on darker coloured

lines, young parts of branches, inflorescence, and juvenile leaves densely ferrugineously hispid, not glandular. Stipules filiform, c. 5 mm, early caducous. *Leaves* evenly distributed along the stems; rachis c. 10–20 cm, petiole 4.5–5.5 cm, with 2 glands, the lower one c. 0.8–1.5 cm above the base, the upper one 2.5–3 cm above the base, raised, circular, concave, c. 1 mm in diameter; glands on rachis below the junctions of a few or all pairs of pinnae, obconical, c. 0.5 mm in diameter; pinnae 7–11 pairs, 3–8 cm, with minute glands at the junctions of the 1 or 2 distal pairs of leaflets, c. 0.2 mm in diameter, concave, raised; leaflets 14–30 pairs per pinna, opposite, sessile, thinly chartaceous, narrowly oblong to linear, 6–7 by 1–1.5 mm, base asymmetrically truncate/narrowly cuneate; apex sharply acute to mucronate, upper surface glabrous, lower surface with scattered, long appressed hairs, margins ciliate; main vein running from the front margin diagonally towards the apex, lateral vein hardly visible. *Inflorescences* consisting of pedunculate spikes, 1–4 together in the axils of the distal leaves; spike c. 3.5–7 by 0.9 cm, peduncle c. 1–2.5 cm; floral bracts absent. *Flowers* sessile, white, bisexual, pentamerous. Calyx campanulate, 1.5–2 mm, glabrous or with a few scattered hairs; teeth triangular or ovate, c. 0.5 mm. Corolla 2–3 mm, glabrous; lobes ovate, acute, c. 1 mm. *Stamens* numerous, c. 4 mm, anthers with a stipitate terminal gland. Ovary stipitate, c. 1 mm, glabrous, stipe c. 1 mm. *Pod* green when young, brownish when old, oblong, with slightly sinuate margins, flattened, 6–10 by 2–3.1 cm, abruptly narrowing into a c. 1 cm long, obcuneiform stalk; valves chartaceous, ferrugineously hispid, bullate across the seeds, with delicate transverse veins, irregularly dehiscent. *Seeds* brown, narrowly elliptic to oblong, c. 8–10 by 4–4.5 mm; areole linear-oblong c. 4–5 by 1 mm; pleurogram not parallel to the margin of the seed, open towards the hilum.

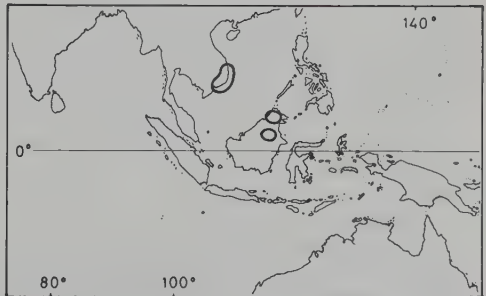


Fig. 5. Range of *Acacia donnaiensis* Gagnep.

Distribution – Cambodia, S Vietnam; in *Malesia*: Borneo (Sabah, Kalimantan). – Fig. 5.

Habitat & Ecology – At riverbanks, in clearing of both primary and secondary forest, in grassland, and in scrub; climbing over trees and shrubs, or scrambling, and often covering large areas in grassland and open scrub; altitude 120–600 m. Flowering and fruiting probably all year round.

**7. *Acacia kekapur*** Nielsen, Opera Bot. 81 (1985) 13, f. 3, 5: 1–8.

*Acacia intsia* auct. non (L.) Willd.: Benth., Lond. J. Bot. 1 (1842) 515, p. p., quoad *Marsden s.n.*, Sumatra.

Scandent shrub or climber c. 10 m long, or rarely a tree to 15 m high, stem 3 cm in diameter. Branchlets slightly angular, armed with 5 rows of up to 3 mm long, stout, recurved prickles, with longitudinal light brown and dark brown lines, densely red-brown glandular puberulous in the ultimate parts, soon glabrescent. Stipules subcordate, ovate, or subreniform (rarely linear), 2–3 by 0.5–2 mm, concave. *Leaves* evenly scattered along the stem; rachis 7–19 cm, adaxially puberulous, often armed with recurved prickles, petiole 2.5–6 cm, gland just above the basal pulvinus, circular to elliptic in outline, 1.5–4 mm long, often somewhat sunken into the rachis but raised in the distal portion and with additional glands on the rachis at the junctions of the 2 or 3 distal pairs of pinnae; pinnae (4–)6–10 pairs, (1.5–)4.5–12.5 cm, glandular puberulous, with glands at the junctions of the 1–3 distal pairs of leaflets; leaflets (7–)15–33 pairs per pinna, opposite, sessile, chartaceous, oblong and most often curved, 7–16 by 1–3(–4) mm; base asymmetrically obliquely truncate, apex rounded, often obscurely acute; both surfaces glabrous or rarely scarcely appressed puberulous, glabrescent, margins often ciliate; main vein starting at the front margin, excentrally, not parallel to the acroscopic margin; lateral veins prominulous, reticulate, with anastomoses close to the back margin. *Inflorescence* consisting of pedunculate glomerules aggregated in a terminal, red-brown haired panicle; glomerules c. 6–8 mm in diameter; floral bracts spoon-shaped, not projecting beyond the flower-buds. *Flowers* yellow, male and bisexual in the same glomerule, pentamerous. Calyx 1.6–2 mm, glabrous to scarcely puberulous, or puberulous in the distal part; teeth triangular ovate, acute, 0.3–0.5 mm. Corolla 2–2.5 mm, glabrous or the lobes with a puberulous midrib; lobes triangular or ovate, acute, 0.4–0.5 mm. *Stamens* 2.8–3.5 mm. Ovary c. 1 mm, villous, stipe c. 1 mm. *Pod* (not seen in

ripe state) brown, oblong, c. 18 by 3.1 cm, valves chartaceous, scarcely glandular hairy, with prominulous, transverse reticulate veins that are prominent and raised across the seeds. Ripe seed not seen.

Distribution – *Malesia*: Singapore, Sumatra, Java.

Habitat & Ecology – Secondary forest, riverine forest, scrub, also recorded from limestone; altitude sea-level up to 1000 m. Fl. Mar., Apr., June, Aug.; fr. Feb., June.

Note – For notes on variation, see Nielsen, l.c.

**8. *Acacia kostermansii*** Nielsen, Opera Bot. 81 (1985) 15, f. 4, 5: 9–14.

Small tree, branchlets terete, with slightly flaking bark, puberulous, with dark glandular hairs in the ultimate parts, very soon glabrescent; prickles minute. Stipules not seen, probably early caducous. *Leaves* evenly scattered along the stem; rachis 8–9.5 cm, scarcely to densely patently puberulous, petiole 2.4–2.6 cm, with a gland just above the basal pulvinus, 4–5 mm above the base, elliptic in outline, slightly raised, not concave, 0.6–1.5 mm, and with smaller, circular glands at the junctions of the 1–5 distal pairs of pinnae; pinnae 4–8 pairs, 3–6.4 cm, patently puberulous, glands at the junctions of the 1–5 distal pairs of leaflets; leaflets 10–17 pairs per pinna, opposite, chartaceous, petiolule 0.2–0.4 mm; leaflets asymmetrically oblong to ovate-oblong, 6–17 by 1.5–6 mm; base asymmetrically obliquely truncate, apex rounded, broadly acute-mucronate, only slightly bent acroscopically; both surfaces scarcely appressed puberulous to densely patently puberulous, main vein starting at about 1/4 of the width of the leaflet from the front margin, nearly parallel to it, 2 or 3 accessory veins issuing from the same point as the main vein, these and the branched lateral veins forming a reticulation strongly raised beneath, visible above. *Inflorescence* consisting of pedunculate glomerules of sessile flowers, c. 12 mm in diameter; aggregated into terminal racemes, shortly patently puberulous and glandular hairy; floral bracts spoon-shaped, not projecting beyond the flowers in bud. *Flowers* bisexual, pentamerous. Calyx 2 mm, puberulous and glandular, teeth very unequal, triangular(-ovate), acute, 0.3–0.9 mm. Corolla 2.8–2.9 mm, puberulous and glandular; lobes narrowly oblong-lanceolate, acute. *Stamens* 5 mm. Ovary 0.7 mm, woolly, stipe 1 mm. *Pod* (not seen in ripe state) yellowish-brown, oblong, abruptly narrowed into a 6 mm long stalk, 7–11 by 1.7–1.8 cm, valves chartaceous, these and the margins with a dense cover of minute, dark-brown

glands, bullate across the seeds, transverse veins branched and anastomosing. *Seeds* elliptic-oblong, flattened, 7.5 by 4.2 mm; areole oblong, 5 by 1.2 mm, pleurogram not parallel to the margin, open towards the hilum.

Distribution — *Malesia*: Lesser Sunda Islands (Sumbawa, W Flores, Alor).

Habitat & Ecology — Savanna, dry scrub, and in hedgerows; altitude 0–200 m. Fl., fr. Apr.–June.

- 9. *Acacia megaladena*** Desv., Desv. J. Bot. 1 (1814) 69; DC., Prod. 2 (1825) 465; Brenan & Exell, Bol. Soc. Brot., sér. 2A, 31 (1957) 31; Nielsen, Adansonia sér. 2, 19 (3) (1980) 350; Fl. Camb. Laos Vietnam 19 (1981) 70, pl. 12. *Acacia arrophula* D. Don, Prod. Fl. Nepal. (1825) 247; DC., Prod. 2 (1825) 465. — *Acacia pennata* (L.) Willd. var. *arrophula* (D. Don) Baker in Hook. f., Fl. Br. India 2 (1878) 298; Prain, J. As. Soc. Beng. 66, 2 (1897) 510; Craib, Fl. Siam. Enum. 1, 3 (1928) 550. *Albizia tenerrima* De Vriese in Miq., Pl. Jungh. 2 (1852) 270. — *Acacia tenerrima* (De Vriese) Miq., Fl. Ind. Bat. 1 (1855) 14. *Acacia paludosa* Blume ex Miq., Fl. Ind. Bat. 1 (1855) 14. *Acacia pennata* auct. non (L.) Willd.: Miq., Fl. Ind. Bat. 1 (1855) 12, p.p., quoad syn. *A. megaladena* Desv. et *A. arrophula* D. Don; Koord.-Schum., Syst. Verz. 1, 1 (1912) 15.

**a. var. *megaladena***

Scrambling shrub or woody climber, 25 m long or more, 3–12 cm in diameter. Branchlets terete, armed with 0.5 mm long recurved prickles, often scarcely developed in the distal parts; young branches and inflorescences (densely) puberulous, with a ± dense cover of glandular hairs, glabrescent. Stipules filiform-linear, 2–3 by 0.5–1 mm, with a widened base, puberulous, caducous. *Leaves* evenly distributed along the stem; rachis (6.2–)8.5–23.5 cm, puberulous or subglabrous, petiole 2–6.5 cm, with a gland 0.9–4 cm above the base, i.e. at or above the middle of the petiole, broadly elliptic in outline, margins raised, strongly concave in the central part, (1.5–)2–5 mm; on the rachis with similar glands at the junctions of the 2 or 3 distal pairs of pinnae, sometimes absent; pinnae (5–)11–15 pairs, 2–9.5 cm, eglandular; leaflets c. 40–60 pairs per pinna, opposite, sessile, thinly chartaceous, oblong, 4–8 by 1–1.5 mm, asymmetrically truncate at the base, obtuse or rounded at the apex, ± straight; both surfaces glabrous, margins ciliate; main vein starting at the acroscopic margin, not

parallel to the margin, lateral veins just visible or raised, rarely visibly anastomosing close to the margin. *Inflorescences* consisting of pedunculate glomerules aggregated into terminal or axillary panicles; glomerules 8–9 mm in diameter; floral bracts spoon-shaped, mucronate, concave, glabrous, not projecting beyond the flowers in bud. *Flowers* subsessile, ?white, bisexual, pentamerous. Calyx 2–2.5 mm, glabrous except for occasionally ciliate veins; teeth triangular-ovate, acute, 0.5–1 mm. Corolla 2.5–3 mm, glabrous; lobes (ovate to) oblong, acute, 0.8–0.9 mm. *Stamens* 4.5 mm. Ovary woolly, 0.8–0.9 mm, stipe 0.5–1 mm. *Pod* red-brown, oblong, acuminate at both ends, gradually narrowing into the stalk, flattened, c. 12–18 by 2.1–2.7 cm, valves chartaceous, slightly bullate over the seeds, glabrous, with scattered glandular hairs close to the margins, transverse veins indistinct. *Seeds* dark brown, ovate-elliptic to elliptic, flattened, c. 7–9 by 4.5–5.5 mm; areole elliptic to oblong, 4–6 by 1.5–2.5 mm, pleurogram open towards the hilum.

Distribution — India, Nepal, S China, Burma, Thailand, Indo-China; in *Malesia*: Java.

Habitat & Ecology — Primary and secondary forest, border of ravines, forest margins, often scrambling in cleared areas; altitude 0–800 m. Fl. Jan.–Apr., fr. Jan., May, June.

- b. var. *indochinensis*** Nielsen, Adansonia sér. 2, 19 (3) (1980) 351; Fl. Camb. Laos Vietnam 19 (1981) 73; Opera Bot. 81 (1985) 26, f. 11; Fl. Thailand 4 (2) (1986) 180

*Acacia pennata* auct. non (L.) Willd.: Ridley, Fl. Mal. Pen. 1 (1922) 657, p.p., quoad Kedah and Perlis specimens.

Differs from var. *megaladena* in the following points: Stipules lanceolate-falcate, 2.5–6 by 0.5–1.3 mm. *Leaves*: petiole (1.3–)1.5–4.5 mm; gland 0.6–2.4 cm above the base at or slightly below the middle of the petiole (seen in some fruiting specimens); leaflets 1.5–4.5 by 0.3–0.8 mm; lateral veins hardly visible to prominent.

Distribution — Thailand, Laos, S Vietnam; in *Malesia*: N part of Malaya (Kedah, Perlis), ?Java.

Habitat & Ecology — As the main variety. Fl. June, fr. Feb.–Mar.

Note — Probably not native to Java (Nielsen 1985).

- 10. *Acacia merrillii*** Nielsen, Opera Bot. 81 (1985) 9, f. 2, 3.

*Acacia intsia* auct. non (L.) Willd.: F.-Vill., Nov. App. (1880) 74; Vidal, Sinopsis (1883) t. 45,



f. D; Phan. Cuming. Philipp. (1885) 111; Rev. Pl. Vasc. Filip. (1886) 120; Merr., Philipp. J. Sc., Suppl. 1 (1906) 62.

*Acacia concinna* auct. non (Willd.) DC.: F.-Vill. in Blanco, Fl. Filip. ed. 3 (1883) t. 374.

*Acacia caesia* auct. non (L.) Willd.: Perkins, Fragm. Fl. Filip. (1904) 6; Merr., Philipp. J. Sc., Bot. 5 (1910) 29, quoad *BS 1431, 4578; FB 3255, 5267; Merrill 2812, 3796; Williams 478.*

*Acacia philippinarum* auct. non Benth.: Merr., Enum. Philipp. 2 (1923) 249, p.p., quoad *BS 1431, 4578, 26291; Elmer 18159, FB 5267; Merrill 2812, 3796; Williams 478.*

Scandent shrub or woody climber up to 90 m long, stem 3 cm in diameter. Branchlets terete, armed by 5 rows of up to 1 mm long, recurved prickles; ultimate parts of branches and inflorescences scarcely puberulous, glabrescent, glandular hairs present, pale. Stipules linear, oblong-lanceolate (to ovate-semicordate), 1–3.5 by 0.2–0.6 mm, early caducous. *Leaves* evenly scattered along the stem; rachis 6–15.5 cm, glandular hairy, patently pubescent; petiole (1.5–)2–3.7 cm, gland 0.4–1.5 cm above the base in the proximal half of the petiole, raised, concave, bowl-shaped to urceolate, circular to elliptic in outline, 1.1–2.5 mm in diameter, glands on rachis slightly smaller, often cupular at all (sometimes less) the junctions of the pairs of pinnae; pinnae 5–9(–11) pairs, puberulous, (1.4–)3.4–10.5 cm, leaflets (7–)11–33(–42) pairs per pinna, opposite, sessile, chartaceous, oblong-subfalcate, 4–12 by (1–)1.2–3.5 mm; base asymmetrically rounded-subtruncate,  $\pm$  distinctly auriculate at the basiscopic side; apex straight to slightly bent and rounded, obtuse, or acute; upper surface glabrous, lower surface glabrous to scarcely appressed puberulous, margin scarcely ciliate; main vein subcentral at base, running towards the apex, parallel and closer to the acroscopic margin; lateral veins inconspicuous above,  $\pm$  raised and coarsely reticulate beneath. *Inflorescences* consisting of pedunculate glomerules aggregated into terminal panicles or racemes; glomerules 7–10 mm in diameter; floral bracts strongly concave, aristate, geniculate, projecting slightly beyond the young flowerbuds. *Flowers* sessile, white, male and bisexual in the same glomerule, pentamerous. Calyx broadly obconical, 1.8–2.1 mm; teeth unequal, triangular to ovate, 0.3–0.7(–0.8) mm. Corolla narrowly funnel-shaped, 2–2.5 mm; lobes ovate-oblong, 0.5–1 mm, acute. *Stamens* 4.5–5 mm, anthers glandular. Ovary 0.8–1 mm, puberulous; stipe 1–1.5 mm. *Pod* (not seen fully mature) light brown with dark brown margins, oblong, slightly

sinuate, flattened, 8–13 by 2.5–2.6 cm; valves rigidly chartaceous, glabrous or with dark glandular hairs and glabrescent, slightly bullate over the seeds, veins hardly visible, transverse and anastomosing. *Seeds* unknown.

Distribution – *Malesia*: Philippines, Celebes, Moluccas (Sula Is.: Mangoli; Halmahera).

Habitat & Ecology – Hill-forest, lowland rain forest, secondary forest; at riverbanks, in clearings and cultivated areas; also recorded from limestone; altitude sea-level up to 330 m. Fl. mainly June–Sep., fr. Nov.–Jan.(–May).

Note – For notes on the variation in this species, see Nielsen, l.c.

# **11. *Acacia palawanensis* Nielsen, Opera Bot. 81 (1985) 16, f. 4, 6: 7–11.**

*Acacia pennata* (L.) Willd. var. *arrophula* auct. non (D. Don) Baker: Merr., Philipp. J. Sc., Bot. 5 (1910) 29; Enum. Philipp. 2 (1923) 249.

Scandent shrub or woody climber, 6 m long or more, stem up to 7.5 cm in diameter. Branchlets terete, armed by recurved prickles up to 1.2 mm long and with longitudinal dark grey lines with minute light-coloured transverse lenticels, ultimate parts of branches and inflorescences densely patently puberulous, and with light red sessile glands, soon glabrescent. Stipules oblong-lanceolate to ovate-lanceolate or subfalcate, 4–8 by 1.2–3 mm, base symmetrically subcordate. *Leaves* evenly scattered along the stem; rachis up to 22 cm, patently puberulous, petiole 4–5.5 cm, with 1 or 2 gland(s), lower one 0.4–1.1 cm above the base, in the proximal half of the petiole, circular in outline, saddle-like, 2.5–3 mm in diameter, with an additional gland, 1.1 mm in diameter, sometimes present 2.2 cm above the base; glands on rachis similar but smaller, at the junctions of the proximal pair of pinnae and the 1–4 distal pairs; pinnae 9–11 pairs, 4–9 cm, puberulous; leaflets 28–43 pairs per pinna, opposite, sessile, thinly chartaceous, linear, straight or only slightly curved, 4–9.5 by 1–2 mm, base asymmetrically truncate, apex obtuse, slightly bent; both surfaces glabrous, main vein starting at the acroscopic margin, not parallel to it, lateral veins hardly raised but visible, anastomoses invisible. *Inflorescences* consisting of pedunculate glomerules aggregated into patently puberulous terminal panicles; glomerules composed of sessile flowers, c. 9–10 mm in diameter; floral bracts spatulate or spoon-shaped, not projecting beyond the flower buds. *Flowers* whitish, male or bisexual, pentamerous, glabrous. Calyx 1.5–2.2 mm; teeth broadly triangular-ovate, 0.5–0.6 mm,

acute. Corolla 2.5–3 mm; lobes ovate-oblong, c. 1(–1.5) mm, acute. *Stamens* 4.5–5.5 mm. Ovary glabrous, 1 mm, stipe 1.5 mm. *Pod* brown, flattened, oblong, straight to slightly curved, sometimes somewhat constricted between the seeds, gradually narrowing towards both ends, 11.5–13.5 by 2–2.8 cm, valves chartaceous, not bullate over the seeds, with raised and thickened sutures and a c. 1 mm broad wing along the ventral suture, with hardly visible transversely reticulate veins. *Seeds* very dark brown, irregularly shaped, broadly oblong, 8–11 by 5.5–6 by 1–1.5 mm; areole broadly oblong, c. 8 by 3.5 mm, pleurogram  $\pm$  parallel to the margin and open towards the hilum.

Distribution — *Malesia*: Philippines (Palawan).

Habitat & Ecology — Forest along rivers, forest margins; altitude c. 100 m. Fl. May–June, fr. Apr.

**12. *Acacia pennata* (L.) Willd., Sp. Pl. 4 (1806) 1090; Brenan & Exell, Bot. Soc. Brot. sér. 2, 31 (1957) 100; Backer & Bakh. f., Fl. Java 1 (1963) 557; Nielsen, Adansonia sér. 2, 19 (3) (1980) 352; Fl. Camb. Laos Vietnam 19 (1981) 64; Fl. Thailand 4 (2) (1985) 174. — *Mimosa pennata* L., Sp. Pl. 1 (1753) 522.**

*Acacia pennata* (L.) Willd. var. *canescens* Grah. ex Kurz, J. As. Soc. Beng. 45, 2 (1876) 298. — *Acacia canescens* (Grah. ex Kurz) Gamble, Fl. Madras 1 (1918) 304.

*Acacia hainanensis* Hayata, Ic. Pl. Formos. 3 (1913) 86. — *Acacia pennata* (L.) Willd. subsp. *hainanensis* (Hayata) Nielsen, Adansonia sér. 2, 19 (3) (1980) 352; Fl. Camb. Laos Vietnam 19 (1981) 66, pl. 11: 2–12'.

*Acacia insuavis* Lace, Kew Bull. (1915) 401.

*Acacia macrocephala* Lace, Kew Bull. (1915) 401.

subsp. ***kerrii*** Nielsen, Adansonia, sér. 2, 19 (3) (1980) 353; Fl. Camb. Laos Vietnam 19 (1981) 67, pl. 11: 19–27; Opera Bot. 81 (1985) 18, f. 7; Fl. Thailand 4 (2) (1985) 176.

*Acacia tomentella* Zipp. in Span., Prod. Tim., Linnaea 15 (1841) 199; Miq., Fl. Ind. Bat. 1 (1855) 13.

*Acacia tomentella* Zipp. forma *minor* Miq., Fl. Ind. Bat. 1 (1855) 14.

Scandent shrub or woody climber; branchlets terete, armed with straight to recurved prickles 0.5–4 mm long, with longitudinal dark and light grey lines, ultimate parts of branchlets yellowish to light brown, tomentose to velutinous, with light-coloured glands, glabrescent. Stipules lanceolate, oblong or ovate-lanceolate, sometimes with a cordate base, apex sometimes cuspidate. *Leaves*

evenly scattered along the stem; rachis (7.5–)8.5–21 cm, puberulous, petiole 1.5–4 cm, with a gland 0.3–0.7(–1.4) cm above the base, usually just above the basal pulvinus, circular to broadly elliptic in outline, margins raised, or patelliform (or saddle-like), 1–3.5(–4) mm in diameter, and with similar but smaller glands on the rachis at the junctions of the 1–5 distal pairs of pinnae; pinnae 10–23 pairs, 2–7 cm, puberulous; leaflets 24–75 (–92) pairs per pinna, opposite, sessile, chartaceous, linear-oblong, (2–)2.5–6.5(–7) by 0.3–1.2 (–1.5) mm, base asymmetrically truncate, apex  $\pm$  straight, acute, both surfaces glabrous but margin sometimes ciliate towards base; main vein starting at the front margin, not parallel to it; lateral veins inconspicuous. *Inflorescences* consisting of pedunculate glomerules aggregated into terminal tomentose to woolly racemes or panicles; glomerules 6–8 mm in diameter, floral bracts not projecting the flowerbuds. Flowers sessile or subsessile, yellowish or creamy, fragrant, male or bisexual within one glomerule, pentamerous. Calyx 1.5–2 mm, tube glabrous, teeth triangular-ovate, c. 0.4–0.5 mm, often puberulous at the apex. Corolla 2.1–2.8 mm; lobes oblong, acute, 0.5–1.1 mm. *Stamens* 3.5–5 mm. Ovary 0.7–1 mm, villous, stipe 0.8–1 mm. *Pod* light brown to red-brown, oblong, gradually narrowing into a 0.8–1.5 cm stalk, margins slightly sinuate, (6.5–)9–15.5 by (1.3–)1.7–2.4 cm; valves hardly bullate across the seeds, chartaceous, glabrous, with scattered, sessile glands, veins transverse, hardly visible. *Seeds* (not seen quite ripe) black, broadly elliptic, c. 7 by 5 mm; areole 4.5 by 2 mm, pleurogram parallel to the margin, funicle once contorted beneath the seed.

Distribution — NE India, Burma, Thailand, Indo-China; in *Malesia*: Java, Kagean Is., SW Celebes, Lesser Sunda Islands (Lombok, Komodo, Sumbawa, Flores, Timor).

Habitat & Ecology — Monsoon-forest, scrubby forest, scrub; altitude 20–1200 m. Fl. Nov.–Mar.; fr. Apr.–Aug.

Note — A variable species with four subspecies. Only subsp. *kerrii* is found in *Malesia* (cf. Nielsen 1980). Some of the fruiting specimens from Timor have smaller pods, 6.5–8.5 by 1.3–1.6 cm and shorter leaves (cf. Nielsen 1985).

**13. *Acacia pluricapitata* Steudel ex Benth., Lond. J. Bot. 1 (1842) 516; Backer & Bakh. f., Fl. Java 1 (1963) 557; Nielsen, Adansonia sér. 2, 19 (3) (1980) 354; Fl. Camb. Laos Vietnam 19 (1981) 69, pl. 12: 1–11; Opera Bot. 81 (1985) 20, f. 8, 9: 1–6. — *Acacia pennata* (L.)**

Willd. var. *pluricapitata* (Steudel ex Benth.)

Baker in Hook. f., Fl. Br. India 2 (1878) 298.

*Acacia pennata* auct. non (L.) Willd.: Ridley, Fl. Mal. Pen. 1 (1922) 657.

Scandent shrub or climber up to 21 m or more. Branchlets terete, armed by recurved c. 1 mm long prickles; young branches and inflorescences with a dense cover of dark, sessile glandular hairs, densely puberulous to tomentose, glabrescent, longitudinal lines often visible. Stipules filiform, caducous, c. 2–2.5 mm. *Leaves* evenly distributed along the stem; rachis 9–16.5 cm, densely puberulous, petiole 1–2.2 cm, with a gland 0.5–1.2 cm above the base, above or below the middle of the petiole, obconical or cylindrical, up to c. 0.5 mm high, flattened or concave at the top, c. 0.2–1 mm in diameter and with similar, slightly smaller glands on the rachis at the junctions of all the pinnae, occasionally absent at the two proximal pairs; pinnae (12–)17–33 pairs, 1.2–3.5 cm, eglandular; leaflets (25–)33–67 pairs per pinna, opposite, sessile, chartaceous, linear-oblong, (1.5–)2–3.5 by 0.3–0.5(–0.6) mm; base asymmetrically truncate, apex acute, straight or only very slightly curved; both surfaces glabrous or usually apex and lower part of front margin ciliate; main vein starting at the front margin, diagonal; lateral veins inconspicuous or rarely prominulous, not reticulate. *Inflorescences* consisting of pedunculate glomerules which are either axillary or aggregated into terminal or axillary tomentose to velutinous panicles; peduncles 0.7–1.8 cm, glomerules 7–8 mm in diameter, flowers sessile, floral bracts lanceolate-spathulate, geniculate, not projecting beyond the flower-buds. *Flowers* yellowish white or yellowish green, bisexual, pentamerous. Calyx 1.5–2.5 mm, tube glabrous; teeth ovate, acute, of variable size, (0.3–)0.5(–0.9) mm, glabrous (or scarcely ciliate at the apex). Corolla 1.8–2.5 mm, glabrous; lobes oblong, acute, glabrous. *Stamens* c. 3.5 mm. Ovary 0.5–1 mm, sericeous to woolly, stipe 0.5–1 mm. *Pod* brown, linear-oblong, often with constrictions, flattened, gradually narrowing into a short stalk c. 0.4–0.5 cm; valves chartaceous, bullate over the seeds, transverse veins inconspicuous, with dark sessile glandular hairs, glabrescent. *Seeds* dark brown, broadly elliptic,  $\pm$  asymmetric, flattened, c. 7.5–8 by 5–5.5 mm; areole narrowly elliptic, c. 5 by 2.5 mm, pleurogram parallel to the margin, open towards the hilum.

Distribution – Thailand, S Vietnam; in *Malesia*: Malaya, Sumatra, Java.

Habitat & Ecology – Primary and secondary forest, peat-forest, at riverbanks, forest margins, in

clearings and in open areas, also recorded from limestone; altitude sea-level up to 725 m. Flowering and fruiting throughout the year.

Uses – Grounded leaves applied by the Malays for headache; root bark also employed medicinally.

**14. *Acacia pluriglandulosa*** Verdc., Kew Bull. 32 (1978) 472; Manual New Guin. Legum. (1979) 171; Nielsen, Opera Bot. 81 (1985) 24, f. 8, 10: 11–16.

*Acacia pennata* auct. non (L.) Willd.: Merr. & Perry, J. Arnold Arbor. 23 (1942) 396.

Tall climbing shrub. Branchlets terete, armed with c. 1 mm long recurved prickles, alternating lines distinct, dark brown and light brown, the dark brown ones with glandular hairs and prickles, light brown ones glabrescent; young branches, inflorescences, leaf-rachises and pinnae densely red-brown glandular puberulous, glabrescent. Stipules lanceolate to subfalcate, c. 2.5 by 0.6 mm, covering the young flowerbuds. *Leaves* evenly scattered along the stem; rachis 8–24 cm, petiole 2.8–4.5 cm, with a gland 0.9–1.4 cm above the base in the proximal half of the petiole, circular, obconical, raised sometimes in the distal portion only, 1–2 mm in diameter; glands on the rachis similar but slightly smaller than the petiolar gland, at the junctions of all pairs of pinnae, or glands absent from the lowermost pairs; pinnae 17–25 pairs, 1.5–5 cm; leaflets 40–62 pairs per pinna, opposite, linear-oblong, 2.5–5 by 0.5–0.8 mm; base obliquely truncate, apex acute,  $\pm$  straight; both surfaces glabrous, margins scarcely ciliate; main vein starting at the front margin and parallel to it for about half its length, lateral veins inconspicuous or visible. *Inflorescences* consisting of pedunculate glomerules aggregated into terminal or axillary panicles; peduncles 0.5–1.5 cm; glomerules c. 10–11 mm in diameter, flowers sessile; floral bracts oblong-spathulate, ciliate-laciniate at the apex and not projecting beyond the flowerbuds. *Flowers* white or creamish, bisexual, pentamerous. Calyx 1.5 mm, glabrous; teeth triangular-ovate, 0.5 mm. Corolla 2.5 mm, glabrous; lobes ovate-oblong, acute, glabrous, but margin ciliate or papillose. *Stamens* 4.5 mm. Ovary 1 mm, puberulous, stipe 1.5 mm. *Pod* brown, flattened, narrowly oblong, with slightly sinuate margins, rather abruptly narrowing into a c. 6 mm long stout stalk; valves thinly woody, with transverse fissures (when dry), not bullate over the seeds, with dark sessile glandular hairs, glabrescent, transverse veins inconspicuous. *Seeds* brown, broadly elliptic,



flattened, c. 10–11 by 7 cm; areole c. 7.5 by 3 mm, pleurogram parallel to the margin, open towards the hilum.

Distribution – *Malesia*: New Guinea.

Habitat & Ecology – Low creek-side vegetation, gallery forest, levee in grass swamp; altitude 45–50 m. Fl. Apr., June; fr. Apr.

- 15. *Acacia pseudointsia*** Miq., Fl. Ind. Bat. 1 (1855) 12; Prain, J. As. Soc. Beng. 66, 2 (1897) 249, 511, p.p., excl. var. *ambigua* Prain; Backer & Bakh. f., Fl. Java 1 (1963) 556; Nielsen, Adansonia sér. 2, 19 (3) (1980) 355; Opera Bot. 81 (1985) 13, f. 4; Fl. Thailand 4 (2) (1985) 170.

*Acacia macrocephala* Lace var. *siamensis* Craib, Fl. Siam. Enum. 1 (1928) 549.

Straggling shrub or woody climber, up to 40 m long or more, stems up to c. 3 cm in diameter. Branchlets terete, armed by 5 rows of 1.5–2 mm long, slightly recurved prickles, dark brown to blackish, without longitudinal lines; ultimate parts of branchlets glabrous, without or with only a few scattered hairs. Stipules filiform to linear, c. 2–3 by 0.1–0.2 mm. *Leaves* evenly scattered along the stem; rachis c. 18.5–31 cm, glabrous, petiole 4–7 cm, gland at or somewhat below the middle of the petiole, 1.5–4.5 cm above the base, elliptic to oblong in outline, raised and often cushion-shaped, c. 4–5 mm; glands on the rachis below the junctions of the 1 (or 2) distal pair(s) of pinnae, elliptic, flat, sessile, 2.5–4 mm; pinnae 9–14 pairs, 5.2–11 cm; leaflets 20–62 pairs per pinna, opposite, sessile, chartaceous, narrowly oblong, straight to somewhat curved, (6–)7–13 by 1.2–2.8 cm; base asymmetrically truncate, apex rounded to obscurely acute, both surfaces glabrous; main vein marginal at the base, not parallel to the front-margin, lateral veins prominent, forming a reticulate pattern beneath and anastomosing close to the margin. *Inflorescences* consisting of pedunculate glomerules aggregated into terminal panicles; glomerules 9–10 mm in diameter; floral bracts not projecting beyond the flowers in bud. *Flowers* sessile, yellow or yellowish, fragrant, male and bisexual in the same glomerule, pentamerous. Calyx 1.5–2.3 mm, tube scarcely puberulous to velutinous; teeth ovate to elliptic, acute, scarcely puberulous to velutinous. Corolla 2–3 mm, tube glabrous to puberulous; lobes 0.6–1 mm, ovate to narrowly elliptic, acute, puberulous at apex. *Stamens* c. 4 mm. Ovary densely velutinous to villous, 0.8–1 mm, stipe c. 1 mm. *Pod* (not seen in ripe state)

red-brown, oblong to lanceolate, gradually narrowed towards the stalk, flattened, margins slightly sinuate, 18–25 by 3.4–5 cm; valves chartaceous, glabrous, eglandular, with prominulous veins across the seeds. Ripe seeds not seen.

Distribution – Thailand (SW and Peninsular); in *Malesia*: Malaya, Sumatra, Borneo, Java.

Habitat & Ecology – Primary and secondary rain forest, common at riversides; altitude up to 1000 m. Recorded with the main stem trailing along the ground, with lateral climbing stems up to more than 40 m long climbing in the vegetation.

- 16. *Acacia sulitii*** Nielsen, Opera Bot. 81 (1985) 24, f. 8, 10: 6–10.

Sprawling shrub or woody climber, 20 m long or more, 2 cm or more in diameter. Young branches terete, armed with up to 1 mm long recurved prickles, with distinct longitudinal alternating light brown and dark brown lines; young branches, inflorescences, leaf-rachides and pinnae patently puberulous to setose, dark reddish glandular below the indumentum. Stipules ovate-lanceolate or lanceolate-falcate, 1.2–3 by 0.4–0.7 mm, puberulous by sessile glands. *Leaves* evenly scattered along the stems; rachis (7–)10–18 cm, petiole 1.5–3.1 cm, with a gland 0.5–2.2 cm above the base at or below the middle of the petiole, cylindrical to obconical, 0.4–1.2 mm in diameter, similar glands on the rachis either at all junctions of the pinnae or absent from the proximal 1–3 pairs; pinnae (8–)12–19 pairs, (1.4–)2–7 cm; leaflets (23–)38–63 pairs per pinna, opposite, sessile, chartaceous, linear, 3.5–6 by 0.5–1 mm; base asymmetrically truncate, apex acute,  $\pm$  straight; both surfaces glabrous but proximal basiscopic angle of base sometimes ciliate; main vein starting from the front margin and parallel to the margin for 1/3–1/2 of its length; lateral veins  $\pm$  visible, not anastomosing. *Inflorescences* consisting of pedunculate glomerules aggregated into terminal panicles; glomerules 6.5–7.5 mm in diameter; floral bracts oblong, c. 1 mm, scarcely ciliate, not projecting beyond the flowerbuds. *Flowers* white or yellowish white, male and bisexual within one glomerule, pentamerous. Calyx 1.5–2 mm, glabrous; teeth triangular, acute, 0.2–0.5 mm. Corolla 2–2.2 mm, glabrous; lobes (triangular-) ovate, acute, 0.3–0.8 mm. *Stamens* 4 mm. Ovary 0.6 mm, puberulous, stipe 1 mm. *Pod* (not seen in ripe state), red-brown, oblong, rounded at both ends, 8.5 by 2.2 cm, valves probably chartaceous, glabrous, with scattered glandular hairs close to the

margins, transverse veins hardly visible. Seeds not seen.

Distribution – *Malesia*: Philippines, Celebes.

Habitat & Ecology – Forest, thickets, roadsides, creek banks; altitude sea-level up to 550 m. Fl. May–Aug.

Note – Close to *A. pluriglandulosa* but differing in indumentum, size of glomerules, and the relative size of calyx and corolla (cf. Nielsen, l.c.).

**17. *Acacia tawitawiensis*** Nielsen, Opera Bot. 81 (1985) 22, f. 8, 10: 1–5.

Presumably a woody climber. Young branches terete, armed with up to 0.6 mm long recurved prickles, with distinct longitudinal lines, young branches and inflorescences shortly puberulous and densely reddish glandular hairy. Stipules triangular, acute, c. 0.5–0.8 by 0.3–0.7, glandular puberulous. *Leaves* evenly scattered along the stem; rachis 10–16 cm, patently puberulous and reddish glandular hairy, petiole 1.4–4.5 mm, with a gland 0.9–2 cm above the base in the proximal half of the petiole, shortly obconical, concave, c. 1 mm in diameter, with similar rachis glands at the insertion of the 4 or 5 distal pairs of pinnae; pinnae 8–11 pairs, 2.7–7.7 cm, glandular hairy and patently pubescent; leaflets 22–40 pairs per pinna, opposite, sessile, chartaceous, linear-subfalcate, 4.5–7 by 0.7–1.3 mm, base asymmetrically truncate, angled or auriculate at the basiscopic side, apex acute, bent acroscopically; both surfaces glabrous, but auricle ciliate; main vein starting from the front margin, parallel to the front margin in the proximal half of the leaflet, lateral veins visible but anastomoses invisible. *Inflorescences* consisting of pedunculate glomerules aggregated into terminal panicles; glomerules composed of sessile flowers, 6–9 mm in diameter; floral bracts obovate-oblong, concave, minutely dark-dotted, not projecting beyond the flowerbuds. *Flowers* male and bisexual within one glomerule, pentamerous. Calyx 1.5–2 mm, glabrous but dotted by dark minute glands at the apices of the teeth; the latter triangular, acute, c. 0.3 mm. Corolla 2–2.2 mm, glabrous; lobes ovate, acute, 0.8 mm. *Stamens* 4.5 mm. Ovary, pods and seeds not seen.

Distribution – *Malesia*: Philippines (Tawitawi).

Habitat & Ecology – Not known.

Note – Close to the New Guinean *A. pluriglandulosa*, but leaflets fewer and larger, with a different

base; flowering glomerules smaller, floral bracts with a broader basal portion (cf. Nielsen, l.c.).

**18. *Acacia verheijenii*** Nielsen, Opera Bot. 81 (1985) 16, f. 6: 1–6.

Woody climber. Branchlets armed with c. 0.5 mm long recurved prickles, ultimate parts puberulous and yellowish glandular, glabrescent, longitudinal lines faint or absent. Stipules lanceolate, 1.5 by 0.6 mm, puberulous, early caducous. *Leaves* evenly scattered along the stem; rachis 5–7.5 cm, puberulous, glabrescent, petiole 2(–2.5) cm, with a gland c. 0.4 cm above the base, just above the basal pulvinus, elliptic to narrowly elliptic in outline, with slightly raised margins, 1.5–2.5 mm long; additional glands at the junctions of the pinnae, sometimes absent in the proximal pair, circular in outline, 0.4–0.8 mm in diameter; pinnae 5 or 6 pairs, 2.5–7.5 cm, with glands at the junctions of the three distal pairs of leaflets, circular, sessile, c. 0.3 mm in diameter; leaflets 11–26 pairs per pinna, opposite, sessile, chartaceous, oblong, 4–10 by 1.3–2.7 mm, base asymmetrically truncate, apex broadly acute, with slightly acroscopically bent acumen; upper surface glabrous, lower surface with scattered appressed hairs, glabrescent; main vein starting from the front margin, not parallel, lateral veins forming a reticulation raised beneath, hardly raised above. *Inflorescences* consisting of pedunculate glomerules aggregated into axillary racemes; glomerule c. 13 mm in diameter, pedicels 0.5 mm, floral bracts spoon-shaped, equalling the flowers in bud. *Flowers* bisexual, pentamerous. Calyx 2–2.3 mm, appressed puberulous, with light yellowish glands, teeth triangular, acute, c. 0.5 mm. Corolla 2.5–3 mm, puberulous; lobes oblong-linear, acute, c. 1 mm. *Stamens* 6.5 mm. Ovary 0.7 mm, thinly sericeous, stipe 1 mm. *Pod* (not seen in ripe state) oblong, very abruptly narrowed towards both ends, 10.5–11.5 by 2.4–2.7 cm, valves chartaceous, glabrous, except for a few scattered glands, transverse veins raised and anastomosing, becoming indistinct towards the centre, valves slightly bullate over the seeds. *Seeds* (not seen mature) elliptic, c. 7.5 by 5.5 mm; areole oblong, 4 by 2 mm, open towards the hilum, pleurogram parallel to the margins of the seed.

Distribution – *Malesia*: Lesser Sunda Islands (Flores).

Habitat & Ecology – Not known.

### Subgenus *Phyllodineae*

*Acacia* subg. *Phyllodineae* (DC.) Seringe, Fl. Jard. & Grand. Cult. 3 (1849) 548. —

*Acacia* sect. *Phyllodineae* A.P. DC., Prod. 2 (1825) 448.

*Racosperma* Mart., Hort. Reg. Monac. Sem. (1835); Pedley, J. Linn. Soc. Bot. 92 (1986) 239.

*Acacia* ser. *Botrycephalae* Benth., Lond. J. Bot. 1 (1842) 321.

*Acacia* ser. *Pulchellae* Benth., Lond. J. Bot. 1 (1842) 321.

*Acacia* subg. *Heterophyllum* Vassal, Bull. Soc. Hist. Nat. Toulouse 108 (1972) 139; Pedley, *Austrobaileya* 1 (2) (1978) 82.

Trees or shrubs without prickles, rarely with spinescent stipules (not in Malesia). Leaves (bipinnate or) reduced to polymorphous phyllodes of petiolar origin, petiole and rachis with extrafloral nectaries.

Cytology — Chromosomes  $2n = 26$  (see Vassal, l.c.); most frequently diploid.

Distribution — Mainly Australia (> 900 species), a few species scattered in the area from Hawaii to the Mascarene Islands; in Malesia 11 indigenous species, of which 1 endemic. — Fig. 6.

Notes — The infrasubgeneric classification is according to Pedley (1978: 81).

Several species of subg. *Phyllodineae* have been tried in cultivation, mostly as ornamentals. *Acacia auriculiformis* and *A. mangium*, both native to E Malesia and NE Australia, are the most common species in cultivation. Several species of sect. *Pulchellae*, native to subtropical and temperate Australia, with mature bipinnate leaves, have been tried or are being cultivated especially in the montane areas of Java and the Malay Peninsula.

For further notes on the cultivated species, see p. 206.

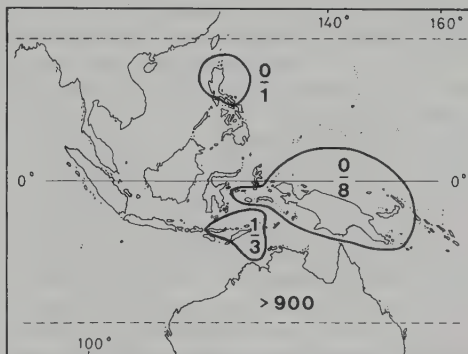


Fig. 6. Range of *Acacia* subg. *Phyllodineae* (DC.) Seringe in Asia. The figures above the hyphen indicate the number of endemic species, those below the hyphen indicate the total number of species.

### Section *Juliflorae*

*Acacia* subg. *Phyllodineae* sect. *Juliflorae* (Benth.) Maiden & Betche, Census Pl. N.S.W. (1916) 95; Pedley, *Austrobaileya* 1 (2) (1978) 83, 124. — *Acacia* subser. *Juliflorae* Benth., Lond. J. Bot. 1 (1842) 321.

Flowers arranged in spikes on peduncles, single or in pairs, in the leaf-axils, or racemose on a short axillary axis.



**19. *Acacia aulacocarpa*** A. Cunn. ex Benth., Lond. J. Bot. 1 (1842) 378; Pedley, Contr. Qld. Herb. 18 (1975) 16; Verdc., Manual New Guin. Legum. (1979) 163; Pedley, Austrobaileya 1 (2) (1978) 148. — *Racosperma aulacocarpum* (A. Cunn. ex Benth.) Pedley, Austrobaileya 2 (4) (1987) 345.

*Acacia crassicaarpa* auct. non A. Cunn. ex Benth.: Baker f. in Merr. & Perry, J. Arnold Arbor. 23 (1942) 395, p.p., quoad *Brass* 7673.

Slender tree 15–35(–39) m high, bole 12–21 m, d. b. h. 25–90 cm. Branchlets angular, rarely glutinous. Phyllodes straight or falcate, acute or subacute, 7–15 by 0.6–3.5 cm, 4–12 times as long as wide, gradually narrowing into the pulvinus, glaucous green, major veins and margins most often not yellowish; pulvinus 4–7 mm, with a basal gland, elliptic in outline, swollen, with a narrow orifice, c. 1.5 mm in diameter; prominent longitudinal veins 3–7, somewhat crowded towards the basiscopic margin, with numerous  $\pm$  parallel secondary veins which do not anastomose. *Spikes* dense or moderately dense, 2–5.5 by c. 0.4 cm, on scurfy peduncles 2–8 mm, solitary or 2 or 3 together at the base of rudimentary axillary shoots in the axils of the upper phyllodes. *Flowers* (pale) yellow or light greenish cream, pentamerous, bisexual. Calyx broadly cupular, 0.5–1 mm, membranous, glabrous; lobes 0.2–0.3 mm. Corolla 1.2–1.9 mm, lobes 0.6–0.9 mm. *Stamens* 2.5–3 mm. Ovary 0.5 mm, scurfy or puberulous. Pod light brown with dark brown veins, with a whitish bloom when young, oblong, straight, often twisted when old, up to 8 by c. (1)–2 cm; valves coriaceous or subwoody, glabrous, with transverse, slightly oblique, anastomosing veins. *Seeds* transverse, in separate compartments, elliptic-oblong, c. 5–5.5 by 2.5 mm; areole open; funicle folded about five times beneath the seed.

Distribution – E Australia (Queensland south to Richmond R., N part of Northern Territory); in *Malesia*: New Guinea.

Habitat & Ecology – Savanna, monsoon forest, light rain forest, or secondary forest in areas flooded during the rainy season, scrub forest, stony or sandy soils; altitude 15–60 m. Fl. Sep.; fr. Sep.–Jan.

Field notes – Crown moderately narrow, bole sometimes slightly fluted or spurred at the base. Bark brown, dark grey to grey, fissured, sometimes peeling off in long stripes, inner bark red, sapwood yellowish, heartwood dark brown.

Uses – Wood reputed for its durability; used for building posts.

**20. *Acacia auriculiformis*** A. Cunn. ex Benth., Lond. J. Bot. 1 (1842) 377; Backer & Bakh. f., Fl. Java 1 (1963) 558; Pedley, Contr. Qld. Herb. 18 (1975) 17; Austrobaileya 1 (2) (1978) 172; Verdc., Manual New Guin. Legum. (1979) 163. — *Racosperma auriculiforme* (A. Cunn. ex Benth.) Pedley, J. Linn. Soc. Bot. 92 (1986) 247.

Spreading tree to 28 m high, bole up to 12 m and 50 cm d. b. h. Branchlets angular, glabrous. *Phyllodes* curved or falcate, acute or subacute, 10–16 by (1.2–)1.5–2(–3) cm, 4–8(–10) times as long as wide, glabrous, greyish green, major veins and margins not yellow, pulvinus 4–6 mm, with at the top a gland, swollen, c. 1 mm in diameter, with a narrow orifice; major prominent longitudinal veins 3 or 4, at the base running together towards the basiscopic margin or in the middle and with several crowded, somewhat anastomosing secondary veins. *Spikes* somewhat interrupted, 8(–10) by 0.6–0.7 cm, on glabrous peduncles, 0.5–0.8 cm, paired in the axils of the distal phyllodes. *Flowers* golden yellow, fragrant, pentamerous. Calyx 0.7–1 mm, glabrous; lobes triangular, 0.2 mm. Corolla 1.7–2 mm, glabrous; lobes reflexed, oblong, c. 1 mm. *Stamens* c. 3 mm. Ovary densely puberulous. *Pod* brown, often glaucous, flat, contorted, with undulate margins, c. 6.5 by 1–1.5(–2.5) cm; valves subwoody, glabrous, veins transverse, anastomosing. *Seeds* black, transverse, elliptic, c. 5 by 3.5 mm; areole large and almost closed; funicle orange, 3.8–5 by 3–5.5 mm, completely encircling the seed.

Distribution – Australia (Queensland and Northern Territory N of 14° S); in *Malesia*: New Guinea, Kai Islands; introduced to W Malesia and naturalized in Malaya.

Habitat & Ecology – *Eucalyptus* savanna, woodlands, a main constituent of *Acacia*–*Melaleuca* forest, on forest edges near swamps, regrowth, common in coastal savanna at the inner edge of mangrove, in monsoon forest, grassland with *Melaleuca*; altitude 0–90 m. Fl., fr. most of the year.

Field notes – Bark grey or dark grey, deeply fissured in old specimens, hard; inner bark cream; sapwood deep cream, heartwood dark brown.

Uses – Poles used for house construction; bark locally collected for tannins. Ornamental roadside tree, especially in W Malesia; also in plantations.

**21. *Acacia crassicaarpa*** A. Cunn. ex Benth., Lond. J. Bot. 1 (1842) 379; Pedley, Contr. Qld. Herb. 18 (1975) 15; Austrobaileya 1 (2) (1978) 147; Verdc., Manual New Guin. Legum. (1979) 166. — *Racosperma crassicaarpa* (A. Cunn. ex Benth.) Pedley, Austrobaileya 2 (4) (1987) 347.

Tree to 33 m high, bole to 18 m high, d.b.h. up to 35 cm. Branchlets angular, scurfy. Phyllodes falcate, 11–20 by 1–4.5 cm,  $2\frac{1}{2}$ –12 times as long as wide, gradually narrowing into the pulvinus, grey, silvergreen, or glaucous green, usually with a yellow margin when dry; pulvinus (4–)5–20 mm; one gland at top of pulvinus, circular in outline, with an orifice, c. 1 mm in diameter; primary longitudinal veins 3–5, yellowish, close to the basiscopic margin at base, secondary veins  $\pm$  parallel, not anastomosing. *Spikes* moderately dense, 4.5–6 by 0.5 cm, on scurfy peduncles 5–10 mm, 2 to 6 together in the upper phyllode axils. *Flowers* yellow, pentamerous. Calyx broadly cupular, 0.5–0.7 mm, membranous, with scurfy, concave lobes, lobed to about halfway down. Corolla widely spreading, glabrous, 1.3–1.6 mm. *Stamens* 2–3 mm. Ovary shortly puberulous. *Pod* dark brown, with a whitish bloom when young, obovoid-oblong, flat, up to 5 by 2–3.5 cm, valves woody, transversely veined but hardly reticulate, glabrous. *Seeds* transverse, in separate compartments, oblong, 5–6 by 2–3 mm; areole large, constricted towards the base, almost closed; funicle thickened, folded, forming a long aril below the seed.

Distribution – Coastal Queensland N of c. 20° S; in *Malesia*: western part of Papua New Guinea.

Habitat & Ecology – Savanna, woodland, on flats dominated by *Melaleuca* and *Tristania*, savanna with *Banksia*, burnt-over open forest; altitude 9–30 m. Fl. Apr., June–Aug.; fr. Mar., Apr., June, Dec.

Field notes – Bole fluting or spurred at base, not buttressed, crown sparse and spreading. Bark rough, grey or grey-brown, deeply fissured; inner bark reddish; sapwood yellow or pale yellow, heartwood (dark) brown.

Uses – Wood used for heavy construction, furniture, flooring, cabinet-making, boat-building and panelling, and for posts in native buildings.

Note – Closely related to *A. aulacocarpa*, but *A. crassicaarpa* has broader pods with the valves more woody, not undulate, without distinct reticulate veins when mature, the phyllodes with longer pulvini and with a yellowish tinge especially on major veins and margins (Verdcourt, l.c.).

**22. *Acacia leptocarpa*** A. Cunn. ex Benth., Lond. J. Bot. 1 (1842) 376; Pedley, Contr. Qld. Herb. 18 (1975) 19; Austrobaileya 1 (2) (1978) 175; Verdc., Manual New Guinea Legum. (1979) 169. — *Racosperma leptocarpum* (A. Cunn. ex Benth.) Pedley, Austrobaileya 2 (4) (1987) 351.

Tree to 12 m high. Branchlets angular in the ultimate portions only, glabrous. *Phyllodes* falcate, subobtusate to acute (or slightly hooked), (10–)12–21(–26) by 1–2.6 cm, 6–15(–17) times as long as wide, glabrous, light green, major veins and margins yellowish; gradually tapering into a c. (3–)5–10 mm pulvinus, with a gland at the top, prominent or inconspicuous, circular, not raised, with a narrow orifice, 0.1–0.5 mm in diameter; major longitudinal veins 3, yellowish, running  $\pm$  symmetrically towards the apex, secondary veins numerous,  $\pm$  parallel, anastomosing. *Spikes* moderately dense, 5–7 by 0.6–0.7 cm, glabrous, on glabrous peduncles, 3–5 mm, in pairs at the base of axillary rudimentary shoots. *Flowers* pale to golden yellow, pentamerous. Calyx cupular, 0.5–1 mm, glabrous; teeth 0.1–0.3 mm, inconspicuous, acute. Corolla 1.6–2.4 mm, glabrous; lobes oblong, acute, c. 1.5 mm. *Stamens* 3–4 mm. Ovary sessile, densely puberulous. *Pod* dark brown, linear, somewhat coiled, flat, raised over the seeds, glabrous, 4–12 by 0.3 cm; valves subwoody, veins inconspicuous. *Seeds* longitudinal, oblong, 3–4 by 2–2.5 mm; areole oblong, c. 2.5 by 1 mm, open towards the hilum; funicle yellow, folded several times beneath the seed.

Distribution – Australia (coastal districts of Queensland N of 25° S, Northern Territory); in *Malesia*: Lesser Sunda Islands (Wetar), S New Guinea.

Habitat & Ecology – Grassland and savanna woodland, monsoon-scrub, often associated with *Banksia*, *Melaleuca* and *Tristania*, often in groups; altitude 10–30 m. Fl. July–Aug.; fr. Oct.–Dec.

Field notes – Bark grey or grey-black, hard, deeply fissured, inner bark dark red, sapwood white, heartwood brown.

Note – The Wetar collection (Gunn & McDonald BVG 1989, CANB, PERTH) is a spindly, 1 m tall, fruiting shrub. The upper vein of the phyllode is slightly less distinct than the other two and the fruiting spikes are 3 cm long.

**23. *Acacia mangium*** Willd., Sp. Pl. ed. 4, 4 (1806) 1053; Pedley, Proc. Roy. Soc. Qld. 74 (1964) 56; Contr. Qld. Herb. 18 (1975) 14; Austrobaileya 1 (2) (1978) 170; Verdc., Manual New Guin. Legum. (1979) 170; Pedley, FAO Rep. MAL/78/009 no. 8 (1982). — *Racosperma mangium* (Willd.) Pedley, Austrobaileya 2 (4) (1987) 352.

*Mangium montanum* Rumph., Amb. 3 (1750) 123, t. 81.

*Acacia glaucescens* auct. non. Willd.: Kanehira & Hatusima, Bot. Mag. Tokyo 56 (1942) 355, quoad Kanehira & Hatusima 13992.

Tree, up to 27 m high, bole straight, up to 13.5 m, 45 cm in diameter; crown spreading. Branchlets acutely triangular, sometimes scurfy but soon glabrous. *Phyllodes*  $\pm$  straight or straight along the basiscopic margin and curved along the acroscopic margin, acute, up to 25 by 3.3–9 cm, 2–5 times as long as wide, dark green, usually covered by a whitish bloom when young, major veins and margins not yellowish, pulvinus 0.5–0.8 cm, with a basal gland, circular, c. 1.5 mm in diameter,  $\pm$  sunken into the petiole, with a narrow orifice, main longitudinal veins 4 (or 5), running contiguously at the base near the basiscopic margin, and with several fine anastomosing secondary veins. *Spikes* rather lax, 8–11 by 0.65–0.9 cm, solitary or paired in the axils of the distal leaves, on pubescent or greyish white tomentose peduncles, 1–1.5 cm long. *Flowers* white, cream, greenish, or pale yellow, pentamerous. Calyx broadly cupular, 0.6–0.8 mm, pubescent to tomentose; lobes 0.1–0.2 mm. Corolla 1.2–1.5 mm, with reflexed oblong lobes c. 0.8–0.9 mm. *Stamens* up to 3.5 mm. Ovary sessile, puberulous. *Pod* brown, linear, coiled, up to 10 by 0.3–0.5 cm; valves membranous to slightly woody, depressed between the seeds, glabrous, veins inconspicuous. *Seeds* held longitudinally in pod; black, glossy, rectangular, 3–5 by 2 mm; areole 2.1 by 1.2 mm, open towards the hilum; funicle folded and forming a fleshy orange aril.

Distribution – E Australia (N of c. 18° S, but absent from Central York Peninsula); in *Malesia*: S New Guinea, Aru Islands, S Moluccas (Amboina, Buru, Ceram), Sula Islands (Sanana, Taliaboe).

Habitat & Ecology – Primary and secondary forest, savanna, regrowth of woodland and savanna, open grassland, poorly drained flood plains, sometimes dominant; altitude 0–195 m. Fl. June–July; fr. Aug., Nov.

Field notes – Bole sometimes spurred and broadly fluted at the base; bark dark brown or brownish grey, fissured; sapwood white to yellowish, heartwood yellowish brown to dark brown, hard.

Uses – Ornamental and, especially in Sabah, extensively planted as a hardwood. The species may be quickly spreading and has a growth rate similar to that of *Paraserianthes falcataria* and may reach a height of 23 m and a diameter of 23 cm in 9 years (cf. Pedley 1982). It seems especially suitable for reforestation of *Imperata* wastelands. The wood makes excellent particle board and could perhaps be used for furniture and cabinet-making.

Note – Hybrids with *A. auriculiformis* have been reported from Sabah (Pedley 1982).

**24. *Acacia pubirhachis*** Pedley, Contr. Qld. Herb. 15 (1974) 15; *Austrobaileya* 1 (2) (1978) 143. — *Racosperma pubirhachis* (Pedley) Pedley, *Austrobaileya* 2 (4) (1987) 354.

Small erect tree, 3–4 m high. Branchlets rather angled, pubescent. *Phyllodes* straight or slightly falcate, with a covering of long white hairs when young, glabrescent, 10–12 by 0.5–0.8 cm, 12–25 times as long as wide; pulvinus c. 2 mm long, pubescent, glabrescent, with a gland at the top of the pulvinus, circular in outline, with an orifice, veins 1 or 2, longitudinal, secondary veins crowded, parallel, neither anastomosing nor running into each other or into the margin at the base. *Spikes* moderately dense, up to 6 cm, subsessile, in pairs in the upper phyllode axils, with densely pubescent rachises and concave acute bracteoles. *Flowers* pentamerous. Calyx cupular, 0.7 mm; lobes obtuse with broad sinuses 0.2 mm, pilose. Corolla 1.6 mm, lobes obtuse, united to the middle, with a conspicuous rib. *Stamens* c. 2 mm. Ovary 0.2 mm, with covering hairs. *Pod* glabrous, 5–7 by c. 1 cm, valves thin. *Seeds* transverse, 5 by 2 mm, funicle folded four times into a basal aril.

Distribution – Coastal Queensland as far south as 18°; in *Malesia* once recorded from Western Province, Papua New Guinea (approx. 8° 40' S 41° 50' E).

Habitat & Ecology – Savanna, in association with *Acacia simsii*. In Australia occurring on poorly drained sand with heath vegetation; flowering Aug.–Sep.

Note – Mr. Pedley drew my attention to this new record. The specimen was collected by Cole and Thomsen, no. *LXT 651*, E of Mata village, on road to Dimisisi, Western Prov., Papua New Guinea.

**25. *Acacia spirorbis*** Labill., Sert. Austro-Caled. (1825) 69, t. 69; Pedley, Contr. Qld. Herb. 18 (1975) 20. — *Racosperma spirorbe* (Labill.) Pedley, *Austrobaileya* 2 (4) (1987) 355.

subsp. ***solandri*** (Benth.) Pedley, *Austrobaileya* 3 (1990) 216. — *Acacia solandri* Benth., Fl. Austral. 2 (1864) 406. — *Racosperma spirorbe* (Labill.) Pedley subsp. *solandri* (Benth.) Pedley, *Austrobaileya* 2 (4) (1987) 355.

Shrub or tree, 12 m high. Branchlets angular, glabrous. *Phyllodes* falcate, acute to hooked, tapering equally to each end or widest above the middle,



9–17 by 0.6–1.6 cm, 9–24 times as long as wide, greyish green, major veins and margins not yellowish, pulvinus 2–4 mm, with a gland basal or subbasal, broadly elliptic, c. 0.8 mm, with a narrow orifice, major longitudinal veins 2 (or 3), near the base sometimes concurrent or running into the basiscopic margin, with many crowded anastomosing secondary veins. *Spikes* open, 3–8 by c. 0.8 cm, on glabrous peduncles, 0.5–1 cm, in axillary pairs. *Flowers* golden yellow, pentamerous. Calyx cylindrical, 0.8–1 mm, glabrous, sinuately lobed; teeth c. 0.3 mm. Corolla 1.8–2.5 mm, glabrous, divided to the middle, lobes strongly reflexed. *Stamens* 2.5–3.5 mm. Ovary densely pubescent, sessile. *Pod* brown, flat, coiled, up to 10 by 3.5–5.5 cm, valves glabrous, sometimes bullate over the seeds, veins inconspicuous. *Seeds* longitudinal or slightly oblique when pod is broad, possibly broadly elliptic, 3.5–5 by 2–3.4 mm, areole large and open; funicle folded several times beneath the seed, forming an aril almost as long as the seed.

Distribution — Australia (coast Central Queensland), Aneityum I. (New Hebrides); in *Malesia*: Papua New Guinea, only once collected (Aroa R.).

Habitat & Ecology — Sandy woods behind the sea beach. Fl. Feb.

Note — The New Guinea collection belongs to subsp. *solandri*. It merges gradually into subsp. *spirorbis*, which occurs in Melanesia (New Hebrides, New Caledonia). Subsp. *spirorbis* has phyllodes  $\pm$  straight, 6–11 cm, 7–12 times as long as broad; subsp. *solandri* has phyllodes  $\pm$  curved, 10–17 cm, 9–24 times as long as broad.

**26. *Acacia wetarensis*** Pedley, Contr. Qld. Herb. 18 (1975) 18. — *Racosperma wetarensis* (Pedley) Pedley, J. Linn. Soc. Bot. 92 (1986) 249.

Small tree with spreading crown to 10 m high and 22 cm d.b.h. Branchlets angular, glabrous or scurfy. *Phyllodes* half-elliptic, basiscopic margin straight to scarcely curved, acroscopic margin curved, often undulate and indented at the junction of the prominent longitudinal veins with the margin, acute, 5–12 by 1.4–3.2 cm, 2.5–4.5 times as long as wide, grey, major veins and margins yellowish; pulvinus 0.5–0.9 cm, with a gland at the top, circular, not swollen, c. 0.5 mm in diameter, with a yellow margin around the orifice; prominent longitudinal veins 4 and about the same number of less prominent longitudinal ones, all concurrent with the basiscopic margin at the base, with numerous tertiary finely reticulate veins in between. *Spikes* rather sparsiflorous, 1.5–2 by 0.25 cm, on glabrous peduncles 0.3–0.5 cm long, solitary or paired in the axils of the distal phyllodes. *Flowers* pentamerous. Calyx broadly cylindrical, glabrous, sinuate, scarcely lobed, 0.4–0.5 mm. Corolla deeply lobed, 1.2–1.5 mm. *Stamens* c. 2.5 mm. Ovary sessile and tomentose. *Pod* (ripe not seen) c. 5 by 1.3 cm, with narrowly winged undulate margin, valves with reticulate veins. Seeds probably transverse.

Distribution — *Malesia*: Lesser Sunda Islands (Wetar).

Habitat & Ecology — Rain forest, coastal scrub, *Eucalyptus* savanna; on coral limestone or volcanic soil; altitude 0–700(–900) m. Fl. Feb., fr. Aug.

Field note — Bark grey, rough and fibrous.

## Section Plurinerves

*Acacia* sect. *Plurinerves* (Benth.) Maiden & Betche, Census Pl. N.S.W. (1916) 90;

Pedley, *Austrobaileya* 1 (2) (1978) 82, 186. — *Acacia* ser. *Plurinerves* Benth., Fl. Austral. 2 (1864) 312.

Flowers arranged in glomerules on peduncles in pairs or clusters, or in racemes in the upper phyllode-axils.

**27. *Acacia confusa*** Merr., Philipp. J. Sc., Bot. 5 (1910) 27; Hayata, Icon. Pl. Form. 1 (1911) 332; Pedley, Contr. Qld. Herb. 18 (1975) 12; Huang & Ohashi, Fl. Taiwan 3 (1977) 154, pl. 507. — *Racosperma confusum* (Merr.) Pedley, J. Linn. Soc. Bot. 92 (1986) 248.

*Acacia richii* auct. non A. Gray: Forbes & Hemsley, J. Linn. Soc. Bot. 23 (1887) 215; Perkins,

Fragm. Fl. Philipp. (1904) 6; Mat. & Hayata, Enum. Pl. Form. (1906) 117.

Tree to 10 m high. Ultimate parts of branchlets angular, glabrous, strongly lenticellate. Stipules corky, broadly triangular, acute, c. 1 mm. *Phyllodes* linear-lanceolate,  $\pm$  parallel-sided, straight to slightly curved, acute, usually with a hooked acumen,

6.5–10 by 0.5–0.9 cm, (7–)10–14 times as long as wide, glabrous; pulvinus up to 2.5 mm, with a gland subbasal to 0.5 cm above the base, narrowly elliptic, slit-like, c. 1 mm; prominent longitudinal veins 5 or more, and several prominulous additional ones, anastomoses scarcely visible but numerous. *Glomerules* c. 7 mm in diameter, solitary or in groups of two, two groups in each axil, on glabrous peduncles, 0.7–1.3 cm. *Flowers* golden to bright yellow, pentamerous. Calyx with membranous lobes, sometimes expanded gradually from the base, but often with a narrow stipe and a broad lamina, 1–1.3 mm, with a few hairs at the top. Corolla 1.5–1.9 mm, usually connate  $\pm$  to the middle, glabrous. *Stamens* c. 3.5 mm. Ovary sessile, glabrous. *Pod* brown, linear, flat, with almost winged margins, membranous, raised over the seeds, transversely veined, 4–9 by 0.7–1 cm. *Seeds* longitudinal, broadly elliptic, 5–6 by 3.5–5 mm, areole large, closed; funicle scarcely thickened, not folded.

Distribution – Taiwan; in *Malesia*: Philippines (Luzon).

Habitat & Ecology – On slopes and in dry forest at low altitudes, very local in the Philippines.

Note – It is difficult to judge whether this is indigenous, or cultivated and naturalized in the Philippines. Cultivated in Malaya (1020–1200 m) and also in Sabah, Java (Bogor) and Sumatra (*Lörzing* 17334, L). The species is close to *A. simsii*, but differs by larger flowers and pods.

**28. *Acacia oraria*** F. Muell., *Fragm.* 11 (1879) 66; Backer & Bakh. f., *Fl. Java* 1 (1963) 559; Pedley, *Contr. Qld. Herb.* 18 (1975) 5; *Austrobaileya* 1 (2) (1978) 217. — *Racosperma orarium* (F. Muell.) Pedley, *J. Linn. Soc. Bot.* 92 (1986) 249.

Spreading tree to c. 10 m high. Branchlets angular and, as the young phyllodes, covered by a whitish bloom, glabrous. *Phyllodes* thick, obovate-falcate, basiscopic margin  $\pm$  straight, acroscopic one curved, broadest above the middle, apex obtuse, base attenuate, 4.5–11 by 1–4.5 cm, 2–3.5(–6) times as long as wide, pulvinus 0.4–0.6 cm, with a gland at the base, elliptic, with distinct rim, 1 mm; prominent longitudinal veins 3, with c. 6 secondary longitudinal veins, densely reticulately veined in between (forming  $\pm$  square 'vein-islands'). *Glomerules* at first covered with white bloom, c. 3–5 mm in diameter, in axillary or sometimes terminal, 3–5-branched racemes which later on may grow into leafy shoots, peduncles glabrous, 0.4–0.7 cm. *Flowers* yellow, pentamerous. Calyx 1–1.4 mm, glabrous, lobes oblong, 0.5–0.7 mm. Corolla

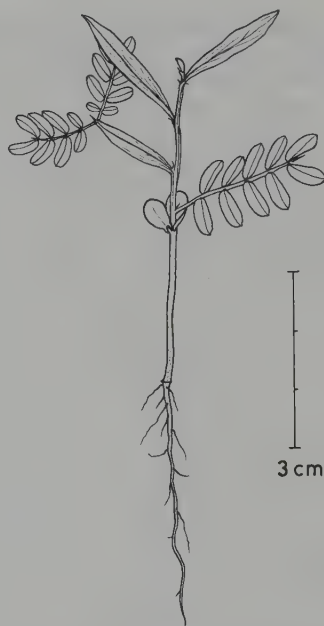


Fig. 7. *Acacia oraria* F. Muell. Seedling (D. Burger H 8).

1.5–1.9 mm, glabrous, lobes oblong, 0.7–0.9 mm. *Stamens* 3–4 mm. Ovary sessile, somewhat scurfy. *Pod* brown, scurfy to glabrous, twisted or coiled, flat, at least 12 by 0.9–1.5 cm, valves chartaceous, with reticulate veins. *Seeds* longitudinal, black, shining, ovate-elliptic to elliptic, 4–5.2 by 3–4.5 mm; areole oblong, c. 3 by 2.5 mm, closed; funicle translucent, red, thickened, passing for 3/4 to completely around the seed, then folded back and considerably thickened to form the hilum.

– Fig. 7.

Distribution – Australia (E coast of Queensland N of 20° S); in *Malesia*: Lesser Sunda Islands (Alor, Flores, Timor).

Habitat & Ecology – Altitude c. 300–700 m.

Note – Known as the 'Suli'-tree from Timor and cultivated in certain areas of Flores, but apparently there indigenous too. Sometimes cultivated in Java on infertile soils (cf. Backer & Bakh. f., l.c.).

**29. *Acacia simsii*** A. Cunn. ex Benth., *Lond. J. Bot.* 1 (1842) 368; Pedley, *Contr. Qld. Herb.* 18 (1975) 13; *Austrobaileya* 1 (2) (1978) 208; Verdc., *Manual New Guin. Legum.* (1979) 171. — *Racosperma simsii* (A. Cunn. ex Benth.) Pedley, *Austrobaileya* 2 (4) (1987) 355.

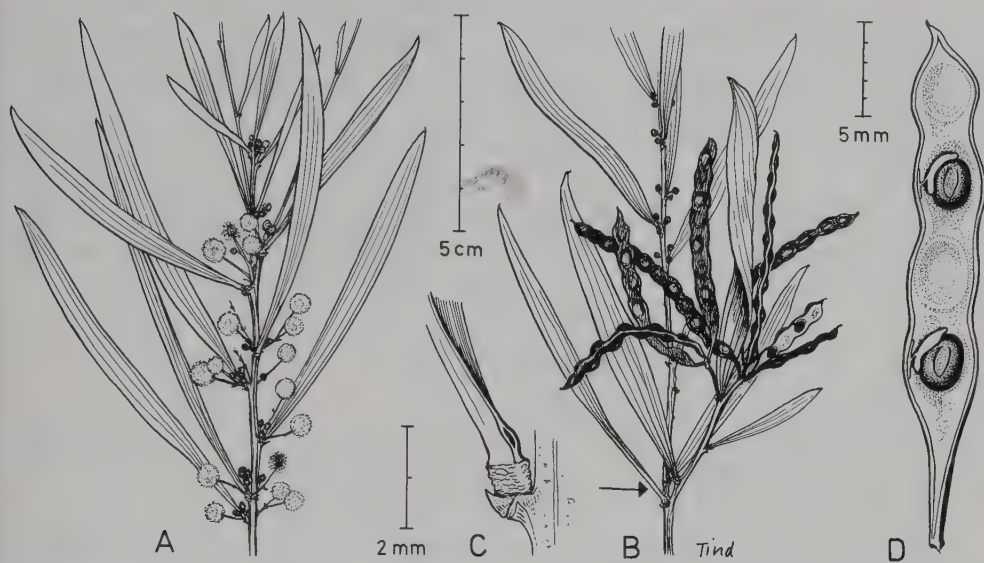


Fig. 8. *Acacia simsii* A. Cunn. ex Benth. A. Flowering branch; B. fruiting branch; C. phyllode base with nectary; D. opened pod with arillate seeds (A: Brass 5698; B–D: Brass 9009).

Shrub or small tree, 7 m high, bole 1–2 m, 2–10 cm d.b.h. Branchlets slender, angular, glabrous, sometimes with conspicuous lenticels. Stipules subpersistent, triangular, up to 1 mm. *Phyllodes* rather membranous, glabrous, punctulate, sometimes papillose on the margins, straight or curved, linear, tapering at both ends, acute or apiculate, 5–11(–14) by 0.2–0.9 cm, 13–33(–50) times as long as wide, light green to dark green, major veins and margins not yellowish; pulvinus 1–2 mm, with a gland at base of phyllode, circular, not conspicuous, 0.2–0.4 mm in diameter and with 1–5 similar glands along the margin; longitudinal veins numerous, of which 1–3 more prominent than the others, widely spaced, obscure when phyllodes are narrow, anastomoses hardly visible. *Glomerules* c. 4 mm in diameter, aggregated into condensed racemes, in 2 pairs, one of each pair maturing before the other, on glabrous peduncles, 0.5–0.8 cm. *Flowers* golden yellow, pentamerous. Calyx membranous, 0.6–0.8(–1) mm, lobes rounded or obtuse, 0.2–0.3 mm, fimbriate. Corolla 1.3–1.5 mm, separating completely or to about the middle into elliptic lobes. *Stamens* c. 3 mm. Ovary sessile, glabrous. *Pod* glaucous, brown, linear, flat, with nerve-like margins, raised over the seeds alternately on each side, 5–8 by 0.4–0.5

(–0.7) cm. *Seeds* longitudinal, broadly elliptic, 3–4 by c. 3 mm, c. 1.5 mm thick; areole oblong, c. 2 by 1 mm, closed or open, funicle ± straight to form a clavate aril below the seed. – Fig. 8.

**Distribution** – Australia (E Australia N of 20° S, N part of Northern Territory); in *Malesia*: New Guinea.

**Habitat & Ecology** – Open grassland, *Eucalyptus* and *Melaleuca* savanna, woodland, edge of rain forest, *Agonis* scrub, regrowth and secondary vegetation, hills and slopes in open country, often forming thick scrub on deforested slopes, soil clayey or lateritic; altitude 0–300 m. Fl. Jan.–Aug.; fr. Mar., May, Aug.–Sep., Dec.

**Field notes** – Bark dark brown or grey-brown, smooth or moderately rough (in old specimens), with numerous series of orange lenticels running horizontally in a tiered arrangement; underbark pale brown, inner bark brown, sapwood white, heartwood golden brown.

#### EXCLUDED AND DUBIOUS

*Acacia frondosa* Willd., Sp. Pl. ed. 4, 4 (1806) 1076; Blume, Cat. (1823) 86 = *Leucaena leucocephala* (Lam.) De Wit.



*Acacia pseudo-arabica* Blume ex Miq., Fl. Ind. Bat. 1 (1855) 8; Verdc., Manual New Guin. Legum. (1979) 172.

According to Verdcourt and my own observations probably a synonym of *Acacia nilotica* (L.) Willd. ex Del.

*Acacia spadicigera* Cham. & Schldl.

Backer & Bakhuizen f., Fl. Java 1 (1963) 557 recorded this as cultivated. Due to a very limited importance it is excluded.

*Acacia sphaerocephala* Cham. & Schldl.

Burkill, Dict. 1 (1935) 23 reported this West-Indian species as being cultivated in Singapore. Due to a very limited importance it is excluded.

*Acacia xylocarpa* A. Cunn. ex Benth., Lond. J. Bot. 1 (1842) 370, non Willd.; Miq., Fl. Ind. Bat. 1 (1855) 16 = *Acacia orthocarpa* F. Muell., fide Pedley, Austrobaileya 1 (2) (1978) 125.

By Miquel stated to occur in the Dampier Archipelago; not yet recorded from Malesia.

## TRIBUS INGEAE

*Mimosoideae* tribus *Ingeae* Benth. in Benth. & Hook. f., Gen. Pl. 1, 2 (1865) 595; Taub. in E. & P., Nat. Pflanzenfam. 3, 3 (1891) 100; Hutch., Gen. Fl. Pl. 1 (1964) 292; Nielsen in Polhill & Raven, Adv. Leg. Syst. 1 (1981) 173.

Calyx with sepals valvate in bud, joined. Stamens numerous and indefinite, connate into a tube at the base; anthers never gland-tipped.

Distribution — Pantropical and warm temperate areas of the world.

## ALBIZIA

*Albizia* Durazz., Mag. Tosca. 3 (1772) 11; Fourn., Ann. Sc. Nat. Bot. 15 (1861) 161; Benth. & Hook. f., Gen. Pl. 1 (1865) 596; Benth., Trans. Linn. Soc. 30 (1875) 557; Taub. in E. & P., Nat. Pflanzenfam. 3, 3 (1891) 106; Hutch., Gen. Fl. Pl. 1 (1964) 294; Nielsen in Polhill & Raven, Adv. Legum. Syst. 1 (1981) 180; Opera Bot. 81 (1985) 27.

*Arthrosprium* Hassk., Retzia 1 (1855) 212.

*Serialbizzia* Kosterm., Bull. Organ. Natuurw. Onderz. Indon. 20 (1954) 15.

*Parasamanea* Kosterm., l.c. 11.

*Parenterolobium* Kosterm., l.c. 19.

Shrubs, trees, or lianas, usually unarmed, the lianas being armed by an unpaired prickles from the base of the leaf-scar. Stipules present, subular to linear or auriculate, often early caducous, in one species transformed into recurved thorns. *Leaves* bipinnate, not sensitive to the touch, rachis and pinnae with extrafloral nectaries; leaflets opposite, sessile or stalked. *Inflorescences* consisting of pedunculate glomerules or corymbs which are either axillary or aggregated into terminal or axillary panicles; floral bracts small, linear-oblong, or absent. *Flowers* pentamerous, usually dimorphic (uniform in 5 species), the marginal flowers in each flowerhead bisexual, the central flower male and enlarged with a conspicuous nectary. Calyx connate, valvate, rarely circumscissile at the base. Corolla connate, valvate. *Stamens* numerous, united into a tube at the base; anthers eglandular. Ovary solitary, sessile or stipitate. *Pods* chartaceous to coriaceous, straight (or curved), flat, dehiscent, tardily dehiscent or indehiscent, seeds usually not in separate chambers; valves yellowish, brownish or blackish outside, not reddish inside; endocarp not forming envelopes



**Taxonomy** — In earlier papers [Nielsen (l.c. 1981); Nielsen, Guinet & Baretta-Kuipers, Bull. Mus. Natn. Hist. Nat. Paris, sér. 4, 5, sect. B, *Adansonia* no 3 (1983) 303] the reasons for the exclusion of sect. *Lophantha* and sect. *Spiciflorae* from the genus *Albizia* were given. It remains an open question whether the genera *Cathormion* and *Samaena* should be included, but until the American members of the genus have been revised they are kept separate.

The wide distribution of *Albizia* seems to indicate that it is an ancient genus, which, as *Acacia*, is well adapted to tropical seasonal climates.

**Uses** — Several species are good timber trees and some are important shade trees in coffee and tea plantations.

#### KEY 1 TO THE SPECIES

(flowering specimens)

- 1a. Erect trees or shrubs without a prickle below the leaf-scars . . . . . 2
- b. Scandent shrubs or climbers with an unpaired, often recurved prickle below the leaf-scar . . . . . 26
- 2a. Main vein of leaflets forming the front (i.e., the acroscopic) margin, or nearly so . . . 3
- b. Main vein of leaflets distant by at least 1/4 of the width of the leaflet from the acroscopic margin . . . . . 6
- 3a. Peduncles arranged as a corymb or a raceme at the end of branches. Stamens pink-red distally. Subtropical or warm temperate mainland Asia . . . *A. julibrissin* Durazz.
- b. Peduncles aggregated into terminal, branched panicles. Stamens usually yellowish green distally. . . . . 4
- 4a. Stipules lanceolate to ovate-lanceolate, with one central main vein, 0.4–0.7 by 0.14–0.21 cm. Petiolar gland elliptic, strongly raised and convex, 2.5–4.5 mm. Corolla appressed puberulous . . . . . **6. *A. kostermansii***
- b. Stipules auriculate-cordate, with several veins, 1–1.8 by 0.6–3 cm. Petiolar gland circular to broadly elliptic, raised and sometimes slightly depressed in the central part, 0.8–3 mm in diameter. Corolla most often hirsute by patent hairs . . . . . 5
- 5a. Stipules 1–1.5 by 0.6–3 cm. Petiolar gland elliptic, c. 2–3 mm. Calyx (2–)2.5–5 mm; corolla 6–10 mm . . . . . **3. *A. chinensis***
- b. Stipules c. 1.8 by 1.3 cm. Petiolar gland broadly elliptic to circular, 0.8–1.5 mm in diameter. Calyx 1.5–2 mm; corolla (4–)4.2–4.5 mm . . . **12. *A. philippinensis***
- 6a. Leaves with one pair of pinnae only . . . . . 7
- b. At least some leaves with more than one pair of pinnae . . . . . 13
- 7a. Flowers sessile or subsessile . . . . . 8
- b. Flowers pedicellate . . . . . 9
- 8a. Petiolar gland c. 4–7 mm, usually sunken into the rachis, often with raised margins, situated at the junction of the pinnae. Corolla glabrous or puberulous at the apex of the lobes only . . . . . **18. *A. splendens***



- b. Petiolar gland 1–2.5 mm in diameter, raised, often with a depressed central part, situated just above the base of the petiole. Corolla densely appressed puberulous to sericeous all over . . . . . **17. A. saponaria**
- 9a. Main vein distant by 1/3–1/4 of the width of the leaflet from the front margin . . . . . **7. A. lebbeck**
- b. Main vein central or subcentral . . . . . 10
- 10a. Leaflets drying yellowish green to dark green. Petiolar gland situated well below the junctions of the pinnae, usually about the middle of the petiole. Monsoon areas of mainland Asia . . . . . *Albizia lucidior* (Steudel) Nielsen
- b. Leaflets drying a brownish colour. Petiolar gland situated at the junction of the pinnae or slightly (to 2 mm) below. . . . . 11
- 11a. Petiolar gland flat or slightly depressed, sessile, rhombic to obtriangular in outline, up to 3 mm in diameter. Pedicel of marginal flowers 1–1.5 mm . . . . . **1. A. acle**
- b. Petiolar gland usually raised, often stipitate,  $\pm$  circular in outline, 0.5–1.2 mm in diameter. Pedicel of marginal flowers 3–5(–8.5) mm . . . . . 12
- 12a. Flower clusters (glomerules) 20–40-flowered. Calyx of marginal flowers tubular, narrowly campanulate, cup-shaped (to obconical). Petiolar gland (sessile or) raised,  $\pm$  rimmed, concave, when narrow with an orifice, 0.5–1.2 mm in diameter . . . . . **15. A. rosulata**
- b. Flower clusters (glomerules) 10–15-flowered. Calyx of marginal flowers campanulate. Petiolar gland substipitate to stipitate, concave, c. 0.5–1 mm high, 0.5 mm in diameter . . . . . **5. A. dolichadena**
- 13a. All flowers within a glomerule uniform and of the same size . . . . . 14
- b. Flowers within a glomerule dimorphic, i.e., with an enlarged central flower. . . 19
- 14a. Flowers glabrous all over. Solomon Islands . . . . . *A. salomonensis* C.T. White
- b. At least a part of the flower pubescent . . . . . 15
- 15a. Calyx glabrous. Inflorescence glabrous or sparsely puberulous . . . **13. A. procera**
- b. Calyx pubescent. Inflorescence pubescent . . . . . 16
- 16a. Main vein of leaflets central, subcentral, or subdiagonal . . . . . 17
- b. Main vein of leaflets excentric, situated at (2/5–)1/3–1/4 of the width of the leaflet from the front margin . . . . . 18
- 17a. Petiolar gland raised, circular to elliptic, with a narrow orifice, c. 2.5 mm in diameter . . . . . **10. A. papuensis**
- b. Petiolar gland raised, elliptic to slit-like, concave, but without a narrow orifice . . . . . **19. A. tomentella**
- 18a. Leaves with (9–)11–12 pairs of pinnae, each with 13–17 pairs of rounded and mucronulate leaflets; petiolar gland bowl-shaped, 1.5–2.5 mm in diameter. Calyx 2–2.5 mm; corolla 7–8.5 mm . . . . . **20. A. westerhuisii**
- b. Leaves with (2–)3–7 pairs of pinnae, each with (5–)10–25 pairs of (rounded-) acute, mucronate leaflets. Petiolar gland circular, raised, flat to slightly concave, 0.5–0.8 mm in diameter. Calyx 1–1.5 mm; corolla 4–5 mm **8. A. lebbekoides**
- 19a. Marginal flowers sessile . . . . . 20
- b. Marginal flowers pedicellate . . . . . 21

- 20a. Main vein of leaflets subcentral; leaflets 1–3 (or 4) pairs per pinna, not oblong  
**17. *A. saponaria***
- b. Main vein of leaflets distant by  $1/3$ – $1/5$  of the width of the leaflet from the front margin; leaflets (7–)10–16 pairs per pinna, broadly oblong. Monsoon areas of mainland Asia . . . . . *A. odoratissima* (L. f.) Benth.
- 21a. Stipules first erect and rigid, then becoming recurved and hook-like  
**11. *A. pedicellata***
- b. Stipules inconspicuous and caducous, not transformed into two recurved hooks 22
- 22a. Leaflets 19–29 pairs per pinna, oblong-falcate, acute, 0.1–0.2 mm wide. Northern tropical South America . . . . . *A. carbonaria* Britton
- b. Leaflets 1–12 pairs per pinna, more than 0.5 cm wide. . . . . 23
- 23a. Main vein of leaflets distant by  $1/3$ – $1/4$  of the width of the leaflet from the front margin and nearly parallel to that . . . . . **7. *A. lebbeck***
- b. Main vein of leaflets diagonal to subcentral . . . . . 24
- 24a. Petiolar gland circular, slightly concave, c. 1–1.2 mm in diameter; leaflets subsessile. Flowers in pedunculate corymbs axillary to the distal leaves . . . **2. *A. carriei***
- b. Petiolar gland circular-elliptic, sessile, with slightly raised margins, 1–4 mm in diameter; leaflets 1–5 mm stalked. Flowers usually in peduncled panicles, sometimes with some leaves developing . . . . . 25
- 25a. Flowers in an open corymb, the marginal ones situated below the central one; pedicels 2.5–5 mm. Stamens purple to pink . . . . . **14. *A. retusa***
- b. Marginal flowers arranged in a dense umbel below the central one; pedicel 0.5–2 mm. Stamens white, turning yellow. Monsoon areas of mainland Asia  
*A. lucidior* (Steudel) Nielsen
- 26a. Pinnae 8–20 pairs; leaflets 25–60 pairs per pinna, narrowly oblong to linear, 0.4–0.8 by 0.08–0.2 cm . . . . . **9. *A. myriophylla***
- b. Pinnae (1–)3–7 pairs; leaflets 3–14 pairs per pinna, obovate-ovate, subtrapezoid-oblong; (0.7–)0.9–2.2 by 0.4–1 cm . . . . . 27
- 27a. Distal parts of branches and inflorescences glabrous to scarcely puberulous. Pinnae (1–)3 or 4 pairs; leaflets with a tiny mucro . . . . . **4. *A. corniculata***
- b. Distal parts of branches and inflorescence with an often flocculent, reddish brown, tomentose indumentum. Pinnae 5–7 pairs; leaflets with a triangular cusp  
**16. *A. rufa***

KEY 2 TO THE SPECIES  
 (fruiting specimens)

- 1a. Erect trees or shrubs without a recurved prickles below the leaf-scars . . . . . 2
- b. Scandent shrubs or climbers with an unpaired, often recurved prickles below the leaf-scars . . . . . 24
- 2a. Main vein of leaflets forming the front margin or nearly so . . . . . 3
- b. Main vein of leaflets distant by at least  $1/4$  of the width of the leaflet from the front margin . . . . . 6

- 3a. Pods with distinct transverse veins, valves strongly bullate over the seeds, dehiscent. Subtropical and warm temperate mainland Asia . . . . . *A. julibrissin* Durazz.
- b. Pods with inconspicuous veins, valves not strongly bullate over the seeds, indehiscent . . . . . 4
- 4a. Seeds with a closed, subcircular areole at the micropyle end . . . 3. *A. chinensis*
- b. Seeds with an elliptic to oblong, open areole . . . . . 5
- 5a. Petiolar gland strongly raised, convex, elliptic, 2.5–4.5 mm. Pod dark brown. Seeds (elliptic-)oblong, 5.3 by 3 mm . . . . . 6. *A. kostermansii*
- b. Petiolar gland raised, flat to slightly depressed in the central part, elliptic to circular, 0.8–1.5 mm in diameter. Pod yellowish brown. Seeds broadly ovate-elliptic, 7–8 by 6 mm . . . . . 12. *A. philippinensis*
- 6a. Areole of seeds U-shaped . . . . . 7
- b. Areole of seeds elliptic, oblong or circular . . . . . 10
- 7a. Pods straight to slightly curved . . . . . 8
- b. Pods contorted into a circle . . . . . 9
- 8a. Valves of pod rigidly coriaceous, thick, bullate over the seeds. Seeds c. 21–22 by 12.5–19 by 8–9 mm . . . . . 1. *A. acle*
- b. Valves of pod rigidly chartaceous-subcoriaceous, not particularly bullate over the seeds. Seeds c. 13–16 by 10–14 by 4–4.5 mm . . . . . 18. *A. splendens*
- 9a. Petiolar gland (sessile or) raised,  $\pm$  rimmed, when narrow with an orifice, 0.5–1.2 mm in diameter. Lateral part of pleurogram continuous . . . . . 15. *A. rosulata*
- b. Petiolar gland substipitate to stipitate, concave, c. 0.5–1 mm high, 0.5 mm in diameter. Lateral face of seed with two discontinuous straight lines or pleurogram closed at the edge of the seed . . . . . 5. *A. dolichadena*
- 10a. Pods indehiscent or irregularly breaking up . . . . . 11
- b. Pods dehiscent, splitting along the sutures . . . . . 15
- 11a. Areole in the micropylar half of the seed obtriangular . . . . . 2. *A. carrii*
- b. Areole reaching well above the middle of the seed, usually elliptic, obovate or oblong . . . . . 12
- 12a. Stipules erect when young, later on recurved and thorn-like, often caducous. Leaflets sessile . . . . . 11. *A. pedicellata*
- b. Stipules inconspicuous, very early caducous. Leaflets stalked . . . . . 13
- 13a. Pod subwoody, dark brown, finely transversely ribbed, 30–36 by (5)–6.5–7.5 cm. Solomon Islands (Bougainville) . . . . . *A. salomonensis* C.T. White
- b. Pod chartaceous, yellowish to golden brown, with prominulous or hardly visible veins, up to 22 by 5.5(–6) cm . . . . . 14
- 14a. Petiolar gland with slightly raised margin. Pod drying yellowish, strongly bullate over the seeds. Seeds 7–9 by 3.5–4.5 by 1.5 mm . . . . . 14. *A. retusa*
- b. Petiolar gland strongly raised, with a narrow orifice. Pod drying golden brown, not remarkably bullate over the seeds. Seeds unknown . . . . . 10. *A. papuensis*
- 15a. Leaves often with 1 pair of pinnae only. Seeds orbicular; areole circular, pleurogram parallel to the margin of the seed. Monsoon areas of mainland Asia

*A. lucidior* (Steudel) Nielsen



- b. Leaves usually with at least 2 pairs of pinnae. Seeds usually distinctly longer than wide; if occasionally orbicular, then areole ovate-elliptic with pleurogram not parallel to the margins . . . . . 16
- 16a. Main vein of leaflets subcentral, central, or diagonal . . . . . 17
- b. Main vein of leaflets distinctly excentric; distant by  $1/3$ – $1/5$  of the width of the leaflet from the front margin . . . . . 20
- 17a. Petiolar gland strongly raised, with a narrow orifice . . . . . **10. A. papuensis**
- b. Petiolar gland flat or with slightly raised margins, circular, elliptic or slit-like in outline . . . . . 18
- 18a. Pod glabrous with inconspicuous transverse veins, margins not thickened. Seeds obovate-elliptic to elliptic . . . . . **13. A. procera**
- b. Pod puberulous when young, glabrescent, with a prominent, dense, reticulate, transverse venation. Seeds ovate, ovate-elliptic or oblong. . . . . 19
- 19a. Leaves with 1 or 2 (or 3) pairs of pinnae; terminal pair of pinnae with 2 or 3 (or 4) pairs of leaflets; apex of leaflets acuminate to broadly rounded, obtuse, rarely mucronulate; petiolar gland circular to elliptic in outline . . . . . **17. A. saponaria**
- b. Leaves with (2 or) 3 or 4 pairs of pinnae; terminal pair of pinnae with 4 or 5 pairs of leaflets; apex of leaflets acute to rounded; petiolar gland elliptic to slit-like . . . . . **19. A. tomentella**
- 20a. Leaflets sessile or nearly so, stalk up to 0.5 mm long . . . . . 21
- b. Leaflets stalked for at least 1 mm . . . . . 23
- 21a. Leaflets 0.3–0.6 by 0.1–0.2 cm. Seeds elliptic to narrowly obovate-elliptic, 3.2–3.8 by 1.5–1.8 mm. Northern tropical South America . . . . . *A. carbonaria* Britton
- b. Leaflets 0.6–2(–2.7) by 0.2–0.6(–1.4) cm. Seeds obovate-suborbicular or broadly elliptic, 7–8 by 5–6.2 mm . . . . . 22
- 22a. Leaves with (9–)11 pairs of pinnae; petiolar gland circular to elliptic in outline, sharply rimmed by raised margins, 1.5–2.5 mm in diameter. Pod light brown, puberulous at least when young . . . . . **20. A. westerhuisii**
- b. Leaves with (2–)3–7 pairs of pinnae; petiolar gland circular in outline,  $\pm$  raised, flat to slightly concave, 0.5–0.8 mm in diameter. Pod dark brown, glabrous . . . . . **8. A. lebbekoides**
- 23a. Fruiting peduncles axillary to leaves. Pods straw to light brown. Seeds elliptic to suborbicular, 8–10 by 6–7.5 mm . . . . . **7. A. lebeck**
- b. Fruits in panicles. Pods dark brown. Seeds ovate, 9 by 6 mm. Monsoon areas of mainland Asia . . . . . *A. odoratissima* (L. f.) Benth.
- 24a. Pinnae 8–20 pairs; leaflets 25–60 pairs per pinna, narrowly oblong to linear, 0.4–0.8 by 0.08–0.2 cm . . . . . **9. A. myriophylla**
- b. Pinnae (1–)3–7 pairs; leaflets 3–14 pairs per pinna, obovate-ovate or subtrapezoid-oblong, (0.7–)0.9–2.2 by 0.4–1 cm . . . . . 25
- 25a. Distal parts of branches glabrous to scarcely puberulous. Pinnae (1–)3 or 4 pairs; leaflets with a tiny mucro . . . . . **4. A. corniculata**
- b. Distal parts of branches with an often flocculent, reddish brown, tomentose indumentum. Pinnae 5–7 pairs; leaflets with a triangular cusp . . . . . **16. A. rufa**

1. *Albizia acle* (Blanco) Merr., Philipp. J. Sc., Bot. 5 (1910) 25; Nielsen, Opera Bot. 81 (1985) 46, f. 27. — *Mimosa acle* Blanco, Fl. Filip. ed. 1 (1837) 738; ed. 2 (1845) 509; ed. 3, 3 (1879) 140. — *Pithecellobium acle* (Blanco) Vidal, Rev. Pl. Vasc. Filip. (1886) 121. — *Serialbizzia acle* (Blanco) Kosterm., Bull. Organ. Natuurw. Onderz. Indon. 20 (1954) 16, p.p., excl. syn. *Pithecellobium attopeuense* Pierre.
- Xylia dolabriformis* auct. non Benth.: Benth., J. Bot. 4 (1842) 417; Trans. Linn. Soc. 30 (1875) 373; Vidal, Cat. Pl. Herb. Manila (1880) 28; F.-Vill., Nov. App. (1880) 73.

Tree with flattish crown, up to 25 m high, stem 80(–125) cm in diameter. Branchlets terete, coarsely lenticellate by reddish, round lenticels, sparsely puberulous, glabrescent. Stipules triangular, caducous, less than 0.5 mm. *Leaves* sparsely puberulous, glabrescent; petiole 0.9–3.7 cm, with a gland at the junction of the pinnae, rhombic to obtriangular, sessile, flat to slightly sunken, to 3 mm; pinnae one pair, unequal, 5.5–11.5 cm, with glands at the junction of the petiolules, obtriangular to elliptic, sunken but with slightly raised margins, 1–1.5 mm; petiolules c. 3–4 mm; leaflets 2–3(–4) pairs per pinna, opposite, chartaceous, unequal-sided, asymmetrically (broadly) ovate or ovate-elliptic, 4–17 by 1.8–8.9 cm, base asymmetrical, half rounded/half cuneate, cuneate, or rounded, apex acuminate, main vein central or subcentral. *Inflorescences* composed of densely puberulous pedunculate glomerules, these clustered on branchlets c. 1–2 cm long, leafless or occasionally with developing leaves; peduncles 2–4 cm, with a terminal glomerule consisting of c. 15 flowers, pedicel 1–1.5 mm. *Flowers* pentamerous, bisexual, dimorphic. Calyx green, subtubular, sometimes unilaterally split, 2–4 mm, short-tomentose; teeth triangular, acute, 0.2 mm. Corolla whitish, funnel-shaped, 6–7 mm, tube glabrous or with a few scattered hairs only; lobes greenish, ovate-elliptic to elliptic-oblong, acute 1.5–2.5 mm, short-tomentose or puberulous. *Stamens* whitish, c. 20 mm, tube equalling the corolla-tube. Ovary sessile, c. 2 mm, glabrous. *Pod* red-brown to blackish, oblong, straight, flattened,  $\pm$  rigidly coriaceous, with the seeds in separate segments, 17–33 by 2.8–4.7 by 1 cm, thick, indehiscent, glabrous, valves bullate over the seeds, with prominent to inconspicuous veins, segments 2.3–3.9 cm. *Seeds* blackish, suborbicular, ellipsoid, or ovoid-ellipsoid, c. 21–22 by 12.5–14 by 16–19 mm, sometimes irregularly shaped; areole horse-

shoe-shaped, c. 2–3.5 mm wide, pleurogram closed, not continuous between the faces of the seeds, reaching nearly the top of the seed.

*Distribution* — *Malesia*: Philippines (N Luzon to Palawan and Negros), SE Celebes.

*Habitat & Ecology* — Forests at low altitudes, humid forest; altitude 0–150 m. Fl. Mar.–Apr.; fr. Sep., Oct., Jan.–Feb. Apparently leafless when flowering starts, the leaves developing during the flowering.

*Field notes* — Bark with large transverse lenticels, yellowish or grey, scaling in thin, rather large irregular plates.

*Uses* — Recorded to be one of the best cabinet woods; heartwood durable, with a warm-brown colour and a beautiful grain like Walnut. Used for interior finish, panelling and high-grade furniture.

*Note* — For typification see Nielsen, l.c.

2. *Albizia carriei* Kanis, Kew Bull. 32 (1978) 727; Verdc., Manual New Guin. Legum. (1979) 181; Nielsen, Opera Bot. 81 (1985) 45, f. 25.

Semi-deciduous tree to 32 m high, bole to 20 m, d.b.h. to 50 cm. Branchlets sparsely puberulous, glabrescent. Stipules triangular-filiform, 1–2 mm, early caducous. *Leaves*: rachis 4.5–16 cm, puberulous, with a gland 0.5–1.5 cm above the base, circular with raised margins, concave, c. 1–1.2 mm in diameter, and with glands at the junctions of most of the 2–6 pairs of pinnae, these puberulous, 4.5–10(–12) cm, with glands at the junctions of the c. 3 distal pairs of leaflets, elliptic, sessile, depressed in the central part, c. 0.1 mm; leaflets 6–10(–12) pairs per pinna, opposite, subsessile, chartaceous, asymmetrically elliptic-oblong, (10–) 15–25(–30) by (5–) 7–10(–13) mm, base obliquely half cuneate/half rounded, apex rounded, obtuse, often emarginate or mucronulate, both surfaces glabrous or sparsely puberulous, main vein subdiagonal, running slightly closer to the front margin. *Inflorescence* composed of solitary or ternate peduncles axillary to the distal leaves, peduncles 2.5–5 cm, puberulous, bearing corymbs of c. 12 pedicellate flowers, pedicel 4–6 mm, puberulous. *Flowers* dimorphic, pentamerous, bisexual. Calyx narrowly funnel-shaped, puberulous, 3–3.5 mm; teeth triangular, acute, c. 0.5 mm. Corolla narrowly funnel-shaped, puberulous, c. 7 mm; lobes triangular-ovate, acute, c. 3 mm. *Stamens* white, to 25 mm, tube equalling the corolla-tube. Ovary glabrous, c. 3 mm, stipe c. 1 mm. *Pod* dark brown, oblong, straight, flat, rigidly chartaceous, 12–24 by 3–5 cm, irregularly breaking up; valves puberulous when young, glabrescent, with strongly

raised transverse veins, rugose over the seeds. *Seeds* dark brown, oblong-ellipsoid, biconvex, 9–11 by 5–7 by 3 mm; areole in the micropylar half of the seed, light brown, obtriangular, c. 3 by 4 mm, open towards the hilum.

*Distribution* – *Malesia*: New Guinea (Papua New Guinea: Central Prov.).

*Habitat & Ecology* – Deciduous and semi-deciduous forest, lowland and monsoon forest, poor lowland rain forest, gallery forest, gully forest in *Eucalyptus* savanna; mostly on rocky hill slopes above the shore line and in coastal scrub; altitude 0–90(–220) m. Fl. Nov.; fr. Feb., Apr.–Aug., Nov.–Dec.

*Field notes* – Crown widely spreading with more or less drooping branches. Bark light grey to grey-brown, rather smooth and finely fissured to rather rough and more deeply furrowed; inner bark creamy yellow, corky; sapwood creamy yellow; heartwood amber to brown at the centre, coarse, hard, of medium weight.

### 3. *Albizia chinensis* (Osbeck) Merr., Amer. J.

Bot. 3 (1916) 575; Enum. Philipp. 2 (1923) 246, p.p.; Cockb., Trees Sabah 1 (1976) 187; Verdc., Manual New Guin. Legum. (1979) 181; Nielsen, Adansonia sér. 2, 19 (2) (1979) 221; Fl. Camb. Laos Vietnam 19 (1981) 84, pl. 15: 1–6; Opera Bot. 81 (1985) 40; Fl. Thailand 4 (2) (1985) 188, f. 46: 1–6. — *Mimosa chinensis* Osbeck, Dagbok Ostind. Resa (1757) 233. *Mimosa marginata* Lam., Enc. Méth. Bot. 1 (1783) 12. — *Albizia marginata* (Lam.) Merr., Philipp. J. Sc., Bot. 5 (1910) 23.

*Acacia stipulata* DC., Prod. 2 (1825) 469. — *Albizia stipulata* (DC.) Boivin, Encycl. 19, 2 (1838) 33; Benth., Lond. J. Bot. 3 (1844) 92. — *Arthrosprium stipulatum* (DC.) Hassk., Retzia 1 (1855) 212.

*Acacia lomatorcarpa* DC., Prod. 2 (1825) 467.

*Mimosa stipulacea* Roxb., Fl. Ind. ed. 2, 2 (1832) 549.

*Mimosa smithiana* Roxb., Fl. Ind. ed. 2, 2 (1832) 550.

*Inga purpurascens* Hassk., Flora, Beibl. 2 (1842) 103; Cat. Hort. Bog. (1844) 291.

Tree to 30(–43) m high, d.b.h. to 70(–140) cm. Branchlets slightly angular in the distal parts, terete, puberulous to tomentose, glabrescent. Stipules auriculate, c. 1–1.5 by 0.6–3 cm, usually visible in young branches and inflorescence, caducous. *Leaves*: rachis 10–25 cm, puberulous to tomentose, a gland c. 1.5–2 cm above the base, elliptic(–suburceolate), raised, c. 2–3 by 1–1.5

mm; pinnae 4–14 pairs, 4–14 cm, puberulous to tomentose, glabrescent, with glands at the junctions of the 1 or 2 distal pair(s) of leaflets, narrowly elliptic to slit-like, concave, c. 1 mm, or glands absent; leaflets (10–)20–31 pairs per pinna, opposite, sessile, thinly chartaceous; asymmetrically subulate, 6.5–10 by 1.5–3 mm, base truncate, apex sharply acute, at both sides sparsely sericeous or glabrous; main vein and margins sericeous to tomentose, main vein forming the front margin. *Inflorescences* consisting of pedunculate glomerules aggregated into terminal yellowish-green tomentose to hirsute panicles; peduncles up to 5 in clusters, often with auriculate stipules at the base, 1–3 cm long, bearing glomerules of 10–20 sessile or subsessile flowers. *Flowers* dimorphic, bisexual, pentamerous. Calyx tubular to narrowly campanulate, tomentose to hirsute, (2–)2.5–5 mm, teeth triangular, acute, 0.3 mm. Corolla funnel-shaped, puberulous to hirsute especially on the lobes, 6–10 mm, lobes triangular-ovate, acute, 2–2.5 mm. *Stamens* white at base, yellowish green at top, c. 20 mm, tube as long as to slightly longer than the corolla tube. Ovary glabrous, c. 3 mm, sessile. *Pod* yellowish-brownish, flat, straight, often with slightly sinuate margins, indehiscent or irregularly breaking up, 9–15 by 1.8–2 cm, valves rigidly chartaceous, glabrous, veins inconspicuous. *Seeds* elliptic, flattened, c. 7 by 4–5 by 0.5–1 mm; areole at the micropylar end, subcircular, c. 1 mm in diameter, open towards the hilum, pleurogram not parallel to the margin of the seed.

*Distribution* – Larger part of mainland SE Asia with seasonal climate: Ceylon, India, Burma, Indo-China, S China; in *Malesia*: Java, Lesser Sunda Islands (Bali, Lombok, Sumba, Sumbawa, Flores, Timor); not in the Malay Peninsula, in Sumatra and Borneo possibly only cultivated.

*Habitat & Ecology* – Secondary forest, monsoon forest, scrub and grasslands, altitude 10–c. 1700 m (in cultivation up to 2400 m). Fl. Sep.–June; fr. Oct.–Aug.

*Field notes* – Tree with umbellate crown. Bark smooth, grey, living bark red; sapwood white; heartwood brown.

*Uses* – Commonly cultivated in areas with a seasonal climate; shade-tree in coffee and tea plantations; used in reforestation. Wood light, useful for light furniture and planking.

*Note* – The Malesian collections do not differ from the ones from mainland SE Asia. The greatest variation can be observed in India. The Philippine specimens formerly referred to this species by Merrill (1910) have been referred to *A. philippinensis* Nielsen.



**4. *Albizia corniculata* (Lour.) Druce, Bot. Soc.**

Exch. Club Brit. Isles 4 (1917) 603; Merr., Philipp. J. Sc., Bot. 13 (1918) 140; Nielsen, *Adansonia sér.* 2, 19 (2) (1979) 226; Fl. Camb. Laos Vietnam 19 (1981) 98, pl. 18; Opera Bot. 81 (1985) 45, f. 26. — *Mimosa corniculata* Lour., Fl. Cochinch. (1790) 651; ed. Willd. (1793) 800. — *Albizia corniculata* (Lour.) Ricker, J. Wash. Acad. Sc. 8 (1918) 244, nom. inval. *Caesalpinia lebbekoides* DC., Prod. 2 (1825) 483. *Albizia millettii* Benth., Lond. J. Bot. 3 (1844) 89; Hô, Illus. Fl. S. Viêt-nam, ed. 2, 1 (1970) 804. *Albizia scandens* Merr., Philipp. J. Sc., Bot. 4 (1909) 265; *ibid.* 5 (1910) 21; *ibid.* 11 (1916) 87; Enum. Philipp. 2 (1923) 248; Cockb., Trees Sabah 1 (1976) 185. *Albizia nigricans* Gagnep., Bull. Soc. Bot. Fr. 99 (1952) 48; Hô, Illus. Fl. S. Viêt-nam, ed. 2, 1 (1970) 806.

Straggling shrub to 6 m, or climber to 45 m, stem to 10 cm in diameter. Branchlets terete, glabrous, armed by a recurved prickles, to 8 mm, developing in young branches from the outer and lower part of the leaf-scar; stipules filiform-setaceous, c. 1 mm, acute, caducous. *Leaves*: rachis 8–13 cm, glabrous to sparsely puberulous, with glands c. 0.5–1 cm above the base and 0.5–1 cm below the bases of each pair of pinnae; petiolar gland sessile, ovate, flat to concave, c. 0.5 mm; pinnae (1–)3–4 pairs, opposite, 3–11 cm, glabrous to sparsely puberulous, eglandular; petioles to 1 mm; leaflets 3–10 pairs per pinna, opposite, chartaceous, unequal-sided,  $\pm$  obovate or trapezoid-oblong, (0.7–)1.4–2 by (0.4–)0.5–1 cm; base asymmetrically truncate to half cuneate/half rounded, apex rounded to truncate, mucronulate, both surfaces glabrous or lower surface sparsely appressed puberulous; main vein  $\pm$  diagonal or subcentral. *Inflorescences* consisting of pedunculate glomerules aggregated into terminal or axillary, glabrous to sparsely puberulous panicles; peduncles in clusters of 4 or 5, to 1.5 cm, with a glomerule of 15–20 flowers. *Flowers* sessile, dimorphic, pentamerous, bisexual, white or greenish white. Calyx tubular to narrowly funnel-shaped, appressed puberulous to sericeous, 1.5–2 mm; teeth triangular, 0.3 mm. Corolla narrowly funnel-shaped, glabrous to puberulous, 5–6 mm; lobes ovate-elliptic, acute. *Stamens* probably to 10 mm long, the tube equal to slightly shorter than the corolla-tube. Ovary glabrous, 2–3 mm; stipe 0.75–1.5 mm. *Pod* reddish to brown, oblong, straight, flat, chartaceous, 15–18 by 2.5–4 cm, dehiscing along both sutures, glabrous, promi-

nently bullate over the seeds, transverse veins anastomosing. *Seeds* narrowly elliptic, flat, 10 by 4 by 1 mm; areole narrowly elliptic, c. 7.5 by 1 mm, pleurogram parallel to the margins and open towards the hilum.

*Distribution* — S China, Indo-China, Thailand; in *Malesia*: N part of Borneo (Sabah, Brunei, Sarawak), Philippines (Palawan).

*Habitat & Ecology* — Primary and secondary forest especially along rivers, in forest margins, disturbed habitats and open grassy fields, along sandy sea-shores and behind the mangrove; often scandent and sprawling over the top of tall trees in closed forest; in open habitats a straggling shrub; soil sandy; altitude sea-level up to 300 m. Fl. Feb., Apr.–June; fr. June–Aug., Dec.

*Field notes* — Bark pale grey or greenish grey; inner bark reddish; sapwood white or yellow, soft to medium hard.

*Uses* — Pods used as a substitute for soap (Palawan).

*Note* — The leaflets of the specimens from continental Asia are larger, ovate to subrhomboid (Nielsen 1985: 46).

**5. *Albizia dolichadena* (Kosterm.) Nielsen,** Opera Bot. 81 (1985) 47, f. 22: 12–15, f. 27. — *Pithecellobium dolichadenum* Kosterm., Reinwardtia 3 (1954) 9, f. 5. — *Abarema dolichadena* (Kosterm.) Kosterm., Bull. Org. Natuurw. Onderz. Indon. 20 (1954) 36, f. 5.

Tree to 36 m, girth to 1.5 m. Branchlets terete, lenticellate, puberulous, glabrescent. Stipules triangular, acute, rigid, 1–2 mm, caducous. *Leaves*: petiole 1.2–2 cm, sparsely puberulous, with a gland 1 mm below the junction of the pinnae, substipitate to stipitate, circular, concave, c. 0.5–1 mm high, 0.5 mm in diameter; pinnae 1 pair, 3.5–10.5 cm, sparsely puberulous, with glands below the junctions of the petioles, stipitate, raised, circular in outline, c. 1 mm high, 0.5 mm in diameter; leaflets 2 or 3 pairs per pinna, opposite, chartaceous, asymmetrically ovate to elliptic, (3–)5–15 by 2.8–7.2 cm; base  $\pm$  symmetrically broadly cuneate, apex acuminate, both surfaces glabrous but lower with scattered glandular hairs, main vein central. *Inflorescence* composed of pedunculate umbels, densely puberulous, terminal or axillary; peduncle 1.8–3.5 cm, umbel consisting of c. 10–15 pedicellate flowers. *Flowers* dimorphic, pentamerous, bisexual, yellowish; pedicel 3–5 mm. Calyx campanulate, puberulous in the distal part, 2.5–3.5 mm; teeth triangular, acute, 0.5–0.8. Corolla funnel-shaped, puberulous toward the

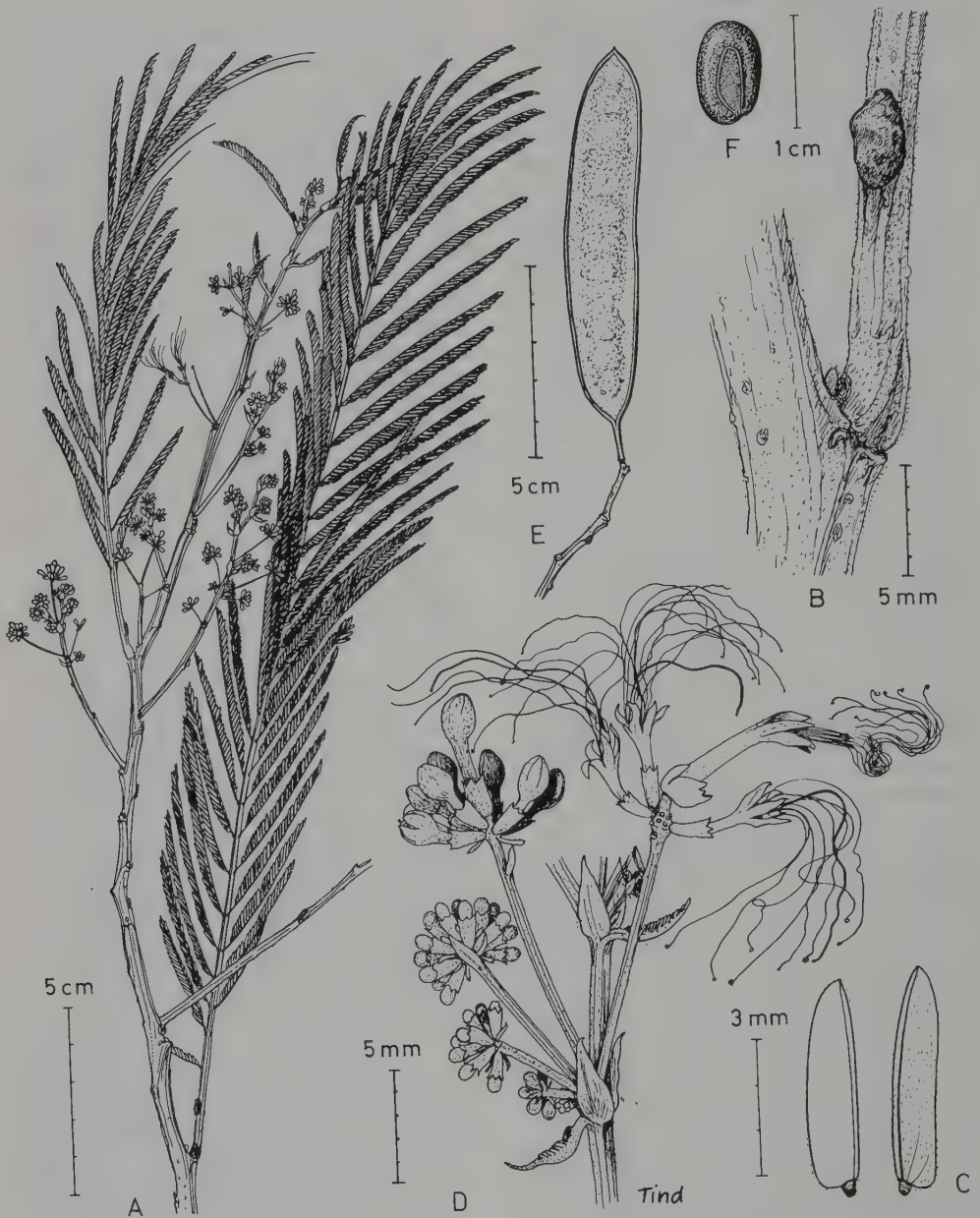


Fig. 10. *Albizia kostermansii* Nielsen. A. Flowering branch; B. petiolar gland; C. leaflets, upper surface (left), lower surface (right); D. part of inflorescence; E. pod; F. seed (A–D: SAN 43209; E, F: Hotta 13935).

base, 8–9 mm; lobes ovate to elliptic-oblong, acute, 3–4 mm. *Stamens* c. 20 mm, tube equaling the corolla tube. Ovary sessile, glabrous, c. 3 mm. *Pod* blackish, woody, contorted into a circle or a very short spiral, the ventral suture forming the outer margin, 7–9 cm in diameter, segmented, segments one-seeded, triangular, 2.4–4 cm wide, 2.2–2.5 cm long in the outer part, indehiscent. *Seeds* black, ovoid, flattened, irregular, 16–18 by 13–14 by 7–8 cm; areole horseshoe-shaped, 1.5–2 mm, only upper pleurogram continuous between both faces of the seed, lower discontinuous.

Distribution – *Malesia*: Borneo (Sabah).

Habitat & Ecology – Primary lowland rain forest in peat swamp or on sandy soil, freshwater swamp-forest; altitude 3–30 m. Fl. May–July; fr. Feb., Apr., July, Nov.

Field notes – Bark grey; inner bark reddish. Sapwood yellow or yellowish white, heartwood dark yellowish brown or brownish.

Note – Close to *A. rosulata* and growing in similar habitats; differs by pinnae with up to 3 pairs of leaflets, calyx campanulate, calyx and corolla having a stronger developed indumentum, and the pleurogram being partly discontinuous between the faces of the seed.

**6. *Albizia kostermansii* Nielsen, Opera Bot. 81 (1985) 40, f. 21.**

Tree, 30 m high, d.b.h. to 85 cm, clear bole to 12 m, straight or crooked. Branchlets strongly angular, shortly yellowish to rusty tomentose in the distal parts, glabrescent, with red-brown, circular lenticles. Stipules lanceolate or ovate-lanceolate, 0.4–0.7 by 0.14–0.21 cm, base subcordate, apex strongly acuminate, tomentose. *Leaves*: rachis 15–27 cm, shortly rusty tomentose, with a petiolar gland 0.6–1.6 cm above the base, elliptic in outline, strongly raised, convex, 2.5–4.5 mm; pinnae 16–25 pairs, opposite or subopposite, 2.7–8 cm, shortly rusty tomentose; leaflets 17–47 pairs per pinna, opposite, sessile, chartaceous, linear-subfalcate, (2.5–)4–6 by 0.8–1.3 mm, base strongly asymmetrically truncate, the acroscopic part adnate to the pinna, apex acute, upper surface glabrous, margins, main vein and major part of lower surface densely appressed puberulous; main vein marginal, running along the front margin. *Inflorescence* composed of pedunculate glomerules aggregated into terminal, shortly tomentose panicles; peduncles 5 or more in a cluster, (1–)1.5–1.7(–2.5) cm, glomerules consisting of (10–)15–20 flowers. *Flowers* dimorphic, bisexual, pentamerous, white. Calyx tubular, 1.8–2 mm, den-

sely appressed puberulous; teeth triangular, acute, 0.1–0.2 mm. Corolla funnel-shaped, 5.5–6.2 mm, densely appressed puberulous; lobes ± equal, ovate-oblong, acute, 1.5–2 mm. *Stamens* c. 15 mm, tube equalling the corolla tube. Ovary sessile, glabrous, c. 2 mm. *Pod* dark brown, flat, straight, oblong, indehiscent, 10.5 by 1.9 cm, valves thinly woody, shortly glandular puberulous with pale glands and with distinct marks over the central seed-bearing part, veins inconspicuous. *Seeds* brown, (elliptic-)oblong, flattened, 5.3 by 3 by 1 mm; areole oblong, 3.5–1.3 mm, pleurogram ± parallel to the margin, open towards the hilum. – **Fig. 10.**

Distribution – *Malesia*: Borneo.

Habitat & Ecology – Frequent in secondary rain forest, in regrowth along roadsides; rare in primary rain forest, where it is often confined to riverbanks; soil sandy; altitude 20–500 m. Fl. July, Aug., Nov.; fr. Feb.

Field notes – Bark smooth, dark grey, grey or light brown, inner bark white, pale reddish or red-brown, sapwood white to yellowish.

Uses – Bark used as a fish poison in Sabah.

**7. *Albizia lebbeck* (L.) Benth., Lond. J. Bot. 3 (1844) 87 ('*lebbeck*'); Backer & Bakh. f., Fl. Java 1 (1963) 554; Hô, Illus. Fl. S. Viêt-nam, ed. 2, 1 (1970) 805; Whitm., Tree Fl. Malaya 1 (1972) 279; Verdc., Manual New Guin. Legum. (1979) 185; Nielsen, Adansonia sér. 2, 19 (2) (1979) 220; Kosterm., Revis. Handb. Fl. Ceyl. 1 (1980) 502; Nielsen, Fl. Camb. Laos Vietnam 19 (1981) 82, pl. 14: 9–15; Fl. Nouv.-Caléd. et Dépend. 13 (1983) 46, pl. 7; Opera Bot. 81 (1985) 30; Fl. Thailand 4, 2 (1986) 186. — *Mimosa lebbeck* L., Sp. Pl. 1 (1753) 516. — *Acacia lebbeck* (L.) Willd., Sp. Pl. ed. 4, 4 (1806) 1066; DC., Prod. 2 (1825) 466. — *Feuillea lebbeck* (L.) O. Kuntze, Rev. Gen. Pl. 1 (1891) 188. — *Albizia latifolia* Boivin, Encycl. 19, 2 (1838) 33; Miq., Fl. Ind. Bat. 1 (1855) 22 (type as for *Albizia lebbeck*).**

*Mimosa speciosa* Jacq., Ic. Pl. Rar. 1 (1783) 119, t. 197; Coll. 1 (1787) 47. — *Acacia speciosa* (Jacq.) Willd., Sp. Pl. 4 (1806) 1066; DC., Prod. 2 (1825) 467; Wight & Arn., Prod. 1 (1834) 275.

*Mimosa sirissa* Roxb., Fl. Ind. 2 (1832) 544.

*Inga leucoxydon* Hassk., Cat. Hort. Bog. (1844) 291; Flora 25, Beibl. 2 (1842) 54. — *Albizia lebbeck* (L.) Benth. β *leucoxydon* Hassk., Nat. Tijds. Ned. Ind. 10 (1856) 208.

*Inga borbonica* Hassk., Cat. Hort. Bog. (1844) 291.



Erect, branched, deciduous tree, 30 m high; d.b.h. 90 cm; bole up to 15 m. Stipules inconspicuous. *Leaves*: rachis 5–10 cm, with a gland 1.5 cm above the base and often additional ones at the junction of some of the pinnae, elliptic, concave, sessile, c. 3 mm; pinnae 1–4(–5) pairs, up to 9 cm, with glands at the junctions of the petiolules, circular, sessile, up to 0.5 mm in diameter; petiolules up to 1 mm; leaflets 3–6(–11) pairs per pinna, opposite, chartaceous, asymmetrically trapezoid, rhomboid, or obovate-oblong, 1.5–5.5(–6.5) by (0.6–)0.9–3.5 cm, base asymmetrically broadly cuneate to truncate or obliquely cordate, apex rounded to truncate, main vein distant by 1/3–1/4 of the width of the leaflet from the front margin, upper surface glabrous to puberulous, lower surface tomentose to glabrous. *Inflorescence* consisting of 2 or more pedunculate corymbs in the distal leaf-axils or arranged in a short raceme at the end of branches, peduncle 10 cm, tomentose to sparsely puberulous, with corymbs composed of c. 15–40 pedicellate dimorphic flowers. *Marginal flowers* pentamerous, pedicel to 4(–7.5) mm. Calyx greenish yellow, funnel-shaped, (2.5–)3.5–5 mm, puberulous, teeth narrowly triangular, acute, 0.75–1 mm. Corolla greenish yellow, funnel-shaped, (5.5–)7.5–11 mm, tube glabrous, lobes broadly ovate, acute, 2.5–4 mm, puberulous at the apex. *Stamens* white to yellow at base, pale green or yellowish green towards the top, 15–30 mm, tube shorter than the corolla tube, 4–5 mm. Ovary sessile, 3–4 mm, glabrous. *Pod* pale straw-coloured to brownish, oblong, gradually narrowing towards both ends, (12–)20–35 by (2.4–)3–5.5(–6.5) cm, dehiscing along both sutures; valves chartaceous, strongly bullate over the seeds, veins inconspicuous. *Seeds* elliptic(-oblong) in outline, to 10 by 6–7 by 1–1.5 mm, areole c. 5 by 2 mm, pleurogram parallel to the margins, open towards hilum.

*Distribution* – Probably native of tropical mainland Asia or E Africa, now pantropical and cultivated; throughout *Malesia*; naturalized in areas with a seasonal climate: Java, Celebes, Lesser Sunda Islands.

*Habitat & Ecology* – Cultivated [not in N Malaya, see Corner, Gard. Bull. Str. Settl. 10 (1939) 268], rarely established in forest. Recorded from limestone and sandy coral loam; altitude sea-level up to 750 m.

*Field notes* – Bark brown to grey, tessellated; wood white.

*Uses* – Planted as a shade tree because of the rather short trunk and wide crown. Bark pounded used for soap in Java; the bark contains tannins. Foliage used for fodder. Wood moderately hard,

rather durable; it seasons well and is used for furniture and general construction.

**8. *Albizia lebbekoides* (DC.) Benth., Lond. J. Bot. 3 (1844) 89; Backer & Bakh. f., Fl. Java 1 (1963) 553; Hô, Illus. Fl. S. Viêt-nam, ed. 2, 1 (1970) 806; Verdc., Manual New Guin. Legum. (1979) 185; Nielsen, Adansonia sér. 2, 19 (2) (1979) 223; Fl. Camb. Laos Vietnam 19 (1981) 93, pl. 17: 1–7; Opera Bot. 81 (1985) 38, f. 20; Fl. Thailand 4 (2) (1985) 194. — *Acacia lebbekoides* DC., Prod. 2 (1825) 467; Decne., Herb. Timor. Descr. (1835) 133.**

*Mimosa carisquis* Blanco, Fl. Filip. (1837) 734; ed. 2 (1845) 507; ed. 3, 3 (1879) 137.

*Pithecolobium myriophyllum* Gagnep., Not. Syst. 2 (1911) 119.

*Albizia julibrissin* auct. non Durazz.: F.-Vill., Nov. App. (1880) 75.

Tree to 32 m high, stem diameter 68 cm. Branchlets terete, glabrous (or tomentellous). Stipules filiform, subulate, 1.5–2 mm, early caducous. *Leaves*: rachis 5–15 cm, glabrous to patently puberulous with one gland 1.5–2.6 cm above the base, additional glands above the junctions of the 2 or 3 distal pairs of pinna, circular, raised, flat to slightly concave, 0.5–0.8 mm in diameter; pinnae (2–)3–7 pairs, subopposite to opposite, puberulous or tomentose, 4–12 cm, glands at the junctions of the 6 or 7 distal pairs of leaflets, elliptic, slightly raised, concave, c. 0.3 mm; leaflets (5–)10–25 pairs per pinna, opposite, sessile, chartaceous, asymmetrically (elliptic-) oblong, lanceolate or subfalcate, 0.7–2(–2.7) by 0.25–0.6(–1.4) cm, base obliquely half rounded/half cuneate, apex rounded to acute, mucronate, both surfaces sparsely appressed puberulous or glabrous, often with a few scattered hairs along the margins; main vein excentric, not parallel to the front margin, distant by about 1/3 of the width of the leaflet. *Inflorescences* consisting of pedunculate glomerules aggregated into terminal and axillary puberulous to shortly tomentose panicles; peduncles 2–5, fascicled, 1–3 cm, glomerules with c. 10–15 flowers. *Flowers* bisexual, sessile, uniform, pentamerous, fragrant. Calyx pale green, narrowly campanulate, 1–1.5 mm, puberulous to tomentose, teeth triangular-deltoid, c. 0.25 mm. Corolla pale green, tubular to narrowly funnel-shaped, 4–5 mm, puberulous to villous, lobes narrowly ovate or elliptic, c. 1 mm. *Stamens* white, to c. 6 mm, tube longer than the corolla-tube, often equalling the corolla. Ovary glabrous, 1–1.5 mm, sessile. *Pod* dark brown, flat, straight or slightly curved, oblong,

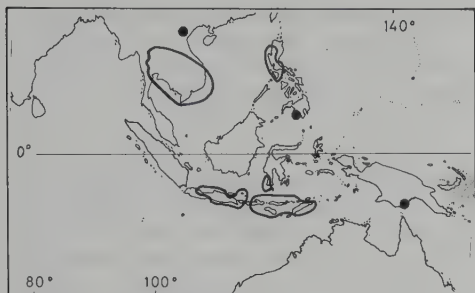


Fig. 11. Range of *Albizia lebbekoides* (DC.) Benth.

8.5–15 by 1.6–2(–2.8) cm, gradually narrowing in the stalk, dehiscing first along the ventral suture; valves thinly chartaceous, glabrous, with distinct marks over the seeds, veins inconspicuous. *Seeds* obovate or suborbicular, flattened, c. 7 by 5 by 1.5 mm; areole ovate-elliptic, 4 by 2 mm, the pleurogram not parallel to the margin, open towards the hilum.

**Distribution** – Thailand, Cambodia, Laos, Vietnam; in *Malesia*: Java, Celebes, Philippines, Lesser Sunda Islands (Sumbawa, Kisar, Sumba, Komodo, Flores, Bali, Timor), New Guinea (once collected). – Fig. 11.

**Habitat & Ecology** – Secondary forest on dry terrain; thin, mixed forest, open land, scattered in savanna, also recorded from red volcanic soil and limestone; altitude 0–800(–?1800) m. Fl. Mar.–June, Sep.; fr. Oct.–Dec., Mar., May.

**Field notes** – Bark smooth, grey or greyish brown. Branches sometimes drooping, with a dense foliage. Living bark beefy red. Wood dirty white.

**Uses** – Used as a shade-tree and for firewood; the wood is durable but too light for construction purposes; the bark is used for tanning.

**Note** – Specimens from Timor have wider pods, 2.4–2.8 cm wide; some specimens from Timor and Bali have larger leaflets, up to 2.7 by 0.9–1.4 cm, but otherwise agree with the species.

**9. *Albizia myriophylla* Benth.**, Lond. J. Bot. 3 (1844) 90; Burkill, Dict. 1 (1935) 88; Hô, Illus. Fl. S. Viêt-nam, ed. 2, 1 (1970) 805; Whitm., Tree Fl. Malaya 1 (1972) 277; Nielsen, Adansonia sér. 2, 19 (1980) 227; Fl. Camb. Laos Vietnam 19 (1981) 101, pl. 18; Opera Bot. 81 (1985) 46; Fl. Thailand 4 (2) (1985) 198, f. 50: 7, 12. — *Albizia myriophylla* Benth. var. *foliolosa* Baker in Hook. f., Fl. Br. India 2 (1878) 301.

*Mimosa microphylla* Roxb., Fl. Ind. ed. 2, 2 (1832) 549, non Poir. (1810). — *Albizia microphylla* (Roxb., non Poir.) MacBride, Contr. Gray Herb. 59 (1919) 3, nom. inval.

*Albizia thorelii* Pierre, Fl. Cochinch. 5 (1899) sub t. 399; Gagnep., Fl. Gén. Indo-Chine 2 (1913) 91. — *Albizia vialeana* Pierre var. *thorelii* (Pierre) Hô, Illus. Fl. S. Viêt-nam, ed. 2, 1 (1970) 804.

Scandent shrub to climber. Branchlets terete, tomentose to puberulous, glabrescent, armed with prickles; prickles unpaired, hook-like, to 5 mm, emerging from the bases of the leaf-scars. Stipules filiform, 2–3 mm. *Leaves*: rachis 10–15 cm, tomentose, with a gland c. 0.5 cm above the base and additional glands at the junctions of the 1–6 distal pairs of pinnae, petiolar gland, elliptic, flat to concave, sessile, c. 2(–5) mm; rachis-glands smaller, circular; pinnae 8–20 pairs, opposite, c. 3.5–5.5 cm, tomentose, with a gland at the junction of the distal pair of pinnae, or absent, narrowly elliptic, sessile, flat, c. 0.5 mm; leaflets opposite, chartaceous, sessile, 25–60 pairs per pinna, narrowly oblong to linear, 0.4–0.8 by 0.08–0.2 cm, base asymmetrically truncate, apex rounded to broadly acute; both surfaces puberulous, glabrescent, with hairs scattered along the margin, main vein subdiagonal. *Inflorescence* composed of pedunculate glomerules aggregated into terminal, tomentose panicles; peduncles to 1.5 cm long, in clusters of 3 or 4, to 1.5 cm, with glomerules of c. 10–12 flowers. *Flowers* sessile, dimorphic, pentamerous, bisexual. Calyx funnel-shaped to campanulate, c. 0.75 mm, puberulous; teeth triangular, acute, c. 0.25 mm. Corolla funnel-shaped, 3.5–5.5 mm, sparsely sericeous; lobes ovate to ovate-elliptic, 1–2 mm. *Stamens* white, tube equalling the corolla-tube. Ovary c. 1 mm, glabrous, stipe c. 1–1.5 mm. *Pod* yellowish to brownish, oblong, flat, chartaceous, c. 14 by 2.5 cm, glabrous, dehiscing first along the ventral suture, with distinct marks over the seeds, and with inconspicuous transverse veins. *Seeds* orbicular to obovate, slightly biconvex, 6.5 by 5 by 1.5 mm, areole c. 4.5 by 1.5 mm, pleurogram parallel to the margins and open towards the hilum.

**Distribution** – N India, E Himalayas, Burma, Thailand, Cambodia, Laos, S Vietnam; in *Malesia*: N Malay Peninsula and off-shore islands (P. Langkawi, Perlis, Kelantan, Trengganu, Perak, Pahang).

**Habitat & Ecology** – Evergreen forest, forest margins, sandy riverbanks and beaches, disturbed habitats; recorded also from old bedded dolomite; altitude 0–300 m.

Uses – According to Burkill (l.c.) the roots are used as a substitute for liquorice, the leaves in a lotion and as a medicine for cough.

Note – Often confused with *Acacia pennata* and allied species.

- 10. *Albizia papuensis*** Verdc., Kew Bull. 32 (1978) 252; Manual New Guin. Legum. (1979) 187. — *Albizia papuana* C.T. White, J. Arnold Arbor. 31 (1950) 88, non F. Muell. (1876).

Tree to 24 m high, d.b.h. 50 cm. Branchlets terete, densely shortly puberulous. Stipules triangular, rigid, caducous, c. 0.8 mm. *Leaves*: rachis 6.5–30 cm, puberulous, with a gland 0.5–2 cm above the base, circular to elliptic in outline, raised, with a narrow orifice, c. 2.5 mm in diameter, and with a similar but smaller gland at the junction of the distal pair of pinnae; pinnae 2–6 pairs, puberulous, (2–)4.8–12 cm, with (2–)3–7 pairs of leaflets; petiolules 1–1.5 mm, puberulous; leaflets opposite, chartaceous, obliquely obovate, elliptic, or subtrapezoid, 1–5 by 0.6–2.2 (–2.5) cm; base asymmetrically cuneate, apex rounded, mucronate, both surfaces finely appressed puberulous; main vein subcentral or subdiagonal. *Inflorescence* composed of pedunculate glomerules, aggregated into terminal, densely puberulous panicles; peduncles to 2.5 cm, bearing glomerules of 10–15 sessile, uniform flowers. *Flowers* bisexual, cream, pentamerous. Calyx tubular, finely appressed puberulous, 3 mm; teeth inconspicuous. Corolla narrowly funnel-shaped or  $\pm$  subtubular, 6.8–7 mm, tube glabrous; lobes oblong, acute, 2 mm, finely appressed puberulous. *Stamens* c. 15–17 mm, tube longer than the corolla tube, shorter than the corolla. Ovary 1.5 mm, glabrous, subsessile. *Pod* (not seen in ripe state) drying golden brown, oblong to linear-oblong, straight, flat, 12–21.5 by 3–3.5 (–6) cm, possibly dehiscent, valves glabrous with faint, transverse, reticulate veins. *Seeds* not seen.

Distribution – *Malesia*: Papua New Guinea.

Habitat & Ecology – Hill forest, riverine forest, also found in coconut-groves near the coast; altitude up to 1200 m.

Field notes – Bark grey-green or dark brown, smooth or striate, with pustular lenticels; sapwood cream, heartwood mid-cream to brown.

- 11. *Albizia pedicellata*** Baker ex Benth., Trans. Linn. Soc. 30 (1875) 563; Whitm., Tree Fl. Malaya 1 (1972) 279; Cockb., Trees Sabah 1 (1976) 189, f. 41; Nielsen, Adansonia sér. 2, 19 (2) (1979) 211, f. 2; Opera Bot. 81 (1985) 44, f. 24.

*Albizia magellanensis* Elmer, Leaf. Philipp. Bot. 2 (1910) 693; Merr., Enum. Philipp. 2 (1923) 247.

*Albizia myriantha* Merr., Philipp. J. Sc., Bot. 10 (1915) 8.

Straight-boled, monopodial tree, up to 33 m high; bole to c. 20 m, 150 cm in diameter. Branchlets ridged, with reddish brown lenticels and very prominent leaf-scars, sparsely rusty puberulous. Stipules to c. 2.5 mm, erect when young, soon recurved and thorn-like, often caducous. *Leaves*: rachis 9–38 cm, sulcate, tomentose or glabrous, with gland(s) c. 1–1.5 cm above the base and below the junctions of the distal pairs of pinnae, circular to elliptic, usually raised, cushion-shaped or flat, 1–4 mm long, distal glands smaller; pinnae 5–13 pairs, 5–12 cm, tomentose, with gland(s) just below the junctions of the 1–4 distal pairs of leaflets; circular with slightly raised margins, c. 0.3 mm in diameter; leaflets 9–18 pairs per pinna, opposite, sessile, subcoriaceous, elliptic-oblong, unequal-sided, 0.8–2.3 by 0.3–1 cm, base asymmetrically truncate to half truncate/half cuneate, apex rounded, mucronate; both surfaces glabrous; main vein distant by c.  $\frac{3}{8}$  of the width of the leaflet from the front margin. *Inflorescences* composed of pedunculate corymbs aggregated into terminal or axillary panicles, puberulous or sometimes glabrescent; peduncles in umbels of 4 or 5, 2–3.5 cm, bearing corymbs consisting of 20–25 pedicellate flowers. *Flowers* dimorphic, pentamerous, bisexual. Calyx green, funnel-shaped to narrowly campanulate, sericeous, (3–)4(–5) mm; teeth triangular, acute, c. 0.3 mm. Corolla whitish, funnel-shaped, sericeous, 6–8 mm; lobes elliptic-ovate to triangular-ovate, acute, 2–3 mm. *Stamens* greenish, especially towards the top, c. 20–25 mm, tube to c. 3.5 mm, shorter than the corolla-tube. Ovary sessile, glabrous, 3.5–4 mm. *Pod* golden yellow, oblong-linear, straight, strongly flattened, c. 6–30 by 4–5 cm, indehiscent, but valves breaking up irregularly; valves thinly chartaceous-membranous, glabrous, veins inconspicuous, reticulation visible over the seeds only. *Seeds* yellow, ovate, strongly flattened, c. 11 by 7.5 by 1 mm, narrowed at the hilum; areole elliptic(–obovate), pleurogram not parallel to the margin of the seed, open towards the hilum.

Distribution – *Malesia*: Malaya, Sumatra (incl. Bangka), Borneo, Philippines (Palawan, Sibuyan, Luzon).

Habitat & Ecology – Primary and secondary lowland rain forest, common in alluvial forest (but rarely collected), often on podsolized sands; altitude



10–240(–500) m. Fl. Mar., Apr., Aug., Dec.; fr. Jan.–Apr., July–Sep.

Field notes – Bole sometimes with buttresses to 1 m high, rounded. Bark pale brown to fawn with reddish brown lenticels arranged roughly horizontally. Thin, hard outer bark, orange inner bark, exudate scanty; sapwood medium hard, white to cream, heartwood chocolate-brown.

Notes – The broad and papery pods are probably well adapted for wind dispersal.

The dark brown heartwood perhaps makes this an excellent timber tree, but the wood may be too soft to be useful.

**12. *Albizia philippinensis*** Nielsen, Opera Bot. 81 (1985) 42, f. 19, 22: 1–6.

*Albizia julibrissin* auct. non Durazz.: Perkins, Fragm. Fl. Philipp (1904) 5, p. p.

*Albizia marginata* auct. non (Lam.) Merr.: Merr., Philipp. J. Sc., Bot. 5 (1910) 23, p. p.

Small to medium-sized tree, up to 12 m, d.b.h. to 40 cm. Branchlets terete, slightly puberulous, glabrescent. Stipules with the juvenile leaves auriculate-cordate, with a caudate apex, c. 1.5 by 1.3 cm, those in the inflorescence ovate, acute, concave, c. 3 mm. *Leaves*: rachis 18–28.5 cm, sparsely puberulous, glabrescent, with petiolar glands 1–16 cm above the base and 0.2–0.8 cm below the junction of the proximal pair of pinnae, broadly elliptic to circular, raised, flat to slightly depressed in the central portion, 0.8–1.5 mm in diameter; pinnae 13–17 pairs, 3.7–8.5 cm, puberulous, glabrescent; leaflets 16–20 pairs per pinna, opposite, sessile, chartaceous, linear to sub-falcate, 3.5–8 by 1.5–2.1(–2.5) mm; base strongly asymmetrically truncate to cuneate, apex sharply acute, bent forwards; upper surface sparsely puberulous in the proximal part, lower puberulous all over, especially along the main vein; main vein marginal at the front margin. *Inflorescences* composed of pedunculate glomerules, aggregated into terminal, yellowish to whitish tomentose-woolly panicles; peduncles 1–1.3 cm, in fascicles of about 5. *Flowers* dimorphic, pentamerous, bisexual. Calyx tubular to cup-shaped, 1.5–2 mm, ± hirsute; teeth triangular acute, c. 0.2 mm. Corolla campanulate, (4–)4.2–4.5 mm, hirsute, lobes ovate, acute, 1–1.3 mm. *Stamens* c. 10–14 mm, tube equalling the corolla-tube. Ovary sessile, glabrous c. 1 mm. *Pod* yellowish brown, oblong, flat, straight, indehiscent, (7–)14–16.5 by 2.1–2.9 cm, valves chartaceous, glabrous, veins inconspicuous, marks over the seeds indistinct. *Seeds* dark olive-green, broadly ovate-elliptic, elliptic, or suborbicu-

lar, sometimes irregular, flat, 7–8 by 6 by 0.6 mm; areole ± elliptic, 5–5.5 by 3–3.2 mm, pleurogram more or less parallel to the margin, open towards the hilum.

Distribution – *Malesia*: Philippines (Luzon, Mindoro).

Habitat & Ecology – A deciduous species of hill forests; altitude 250(?) m. Fl. Aug., Sep.; fr. Apr., June.

Note – Related to *A. chinensis* (Osbeck) Merr., but distinct by smaller stipules, different petiolar glands, smaller flowers, and seeds with a larger areole.

**13. *Albizia procera*** (Roxb.) Benth., Lond. J. Bot. 3 (1844) 89; Backer & Bakh. f., Fl. Java 1 (1963) 554; Hô, Illus. Fl. S. Viêt-nam, ed. 2, 1 (1970) 805, f. 2036; Verdc., Manual New Guin. Legum. (1979) 187, f. 50; Nielsen, Adansonia sér. 2, 19 (2) (1979) 223; Fl. Camb. Laos Vietnam 19 (1981) 89, pl. 16; Opera Bot. 81 (1985) 38, f. 23; Fl. Thailand 4 (2) (1985) 191. — *Mimosa procera* Roxb., Pl. Corom. 2 (1799) 12, t. 121; Fl. Ind. 2, 2 (1832) 548. — *Acacia procera* (Roxb.) Willd., Sp. Pl. ed. 4, 4 (1806) 1063; DC., Prod. 2 (1825) 466; Wight & Arn., Prod. 1 (1834) 275.

*Lignum murinum majus* Rumph., Herb. Amb. 3 (1743) 50, t. 28.

*Mimosa elata* Roxb., Fl. Ind. 2, 2 (1832) 546. — *Acacia procera* var. *roxburghiana* Fourn., Ann. Sc. Nat. Bot. sér. 4, 15 (1861) 164. — *Acacia procera* var. *elata* (Roxb.) Baker in Hook. f., Fl. Br. India 2 (1878) 299.

*Mimosa coriaria* Blanco, Fl. Filip. (1837) 734; ed. 2 (1845) 506; ed. 3, 3 (1879) 136.

Tree to 30 m; d.b.h. to 60 cm; bole straight or crooked, to c. 9 m. Branchlets terete, glabrous. Stipules linear or filiform, to 0.5 mm, caducous. *Leaves*: rachis 10–30 cm, glabrous, a gland 1–2.5 cm above the base, ± narrowly elliptic, sessile, flat and disc-like or with raised margins and concave, 4–10 mm; pinnae 2–5 pairs, opposite or subopposite, 12–20 cm, glabrous, with elliptic glands, c. 1 mm in diameter, below the junctions of the 1–3 distal pairs of petiolules; petiolule c. 2 mm; leaflets 5–11 pairs per pinna, opposite, rigidly chartaceous-subcoriaceous, asymmetrically ovate to elliptic or ± rhomboid or ± trapezoid, 2–4.5 (–6) by 1–2.2(–3.2) cm; base asymmetrical, half truncate/half cuneate, apex rounded or subtruncate, often emarginate, mucronate; both surfaces sparsely appressed puberulous (upper rarely glabrous); main vein slightly excentric, often diagonal. *Inflores-*

*cences* composed of pedunculate glomerules aggregated into terminal axillary sparsely puberulous panicles; peduncles 2–5 in fascicles, c. 0.8–3 cm, glomerules with 15–30 sessile, uniform, bisexual, pentamerous flowers. Calyx light green, tubular to narrowly funnel-shaped, glabrous, (1.5–) 2.5–3 mm; teeth triangular, acute, 0.75–1.2 mm. Corolla greenish white, funnel-shaped, (3.5–) 5–6.5 mm, lower part of tube glabrous; lobes elliptic, acute, 2–2.5 mm, puberulous-sericeous at least at apex. *Stamens* greenish white, to 12.5 mm long, tube longer than the corolla tube, shorter than the corolla. Ovary glabrous, c. 1.5 mm, stipe 0.3–0.5 mm. *Pod* dark brown or red brown, flat, straight, linear-oblong, 11.5–20 by 2–2.5 cm, gradually narrowing in a very short stalk, dehiscent, valves chartaceous without thickened margins, glabrous, veins inconspicuous, with distinct marks over the seeds. *Seeds* obovate-elliptic to elliptic, flattened, c. 7–8.5 by 4.5–6.5 by 15 mm; areole c. 4.5 by 3 mm, pleurogram nearly parallel to the margin, open towards the hilum.

**Distribution** – India, Burma, Indo-China, Thailand, S China (Hainan), Taiwan, Australia (Queensland); in *Malesia*: Java, Philippines, Celebes, Lesser Sunda Islands, Moluccas, Kai Islands, Tanimbar, New Guinea; Borneo (one collection only), Sumatra (possibly cultivated).

**Habitat & Ecology** – Found in areas subject to a dry season; on roadsides, in pyrogenic grasslands, dry gullies, savanna, monsoon-forest, stunted pyric swamp forest or rain forest; altitude up to c. 1545 m. Fl., fr. throughout the year.

**Field notes** – Bark smooth, pale grey-green, yellowish green, yellowish brown or brownish with horizontal ridges, sometimes flaking in thin, small scales, underbark green then orange just below the surface, inner bark pinkish or straw-coloured; sapwood straw or dirty white, heartwood deep brown.

**Uses** – Wood hard and heavy, used for moulding, furniture, cabinets; also for making charcoal.

**Note** – Easily propagated by stumps or cuttings.

**14. *Albizia retusa*** Benth., Lond. J. Bot. 3 (1844) 90; Miq., Fl. Ind. Bat. 1 (1855) 23; Backer & Bakh. f., Fl. Java 1 (1963) 554; Whitm., Tree Fl. Malaya 1 (1972) 280; Cockb., Trees Sabah 1 (1976) 185; Verdc., Manual New Guin. Legum. (1979) 190; Nielsen, Adansonia sér. 2, 19 (2) (1979) 221; Nielsen, Opera Bot. 81 (1985) 30, f. 12; Nielsen, Fl. Thailand 4 (2) (1985) 189, f. 47: 1–5.

*Clypearia maritima* Rumph., Herb. Amb. 3 (1743) 199.

*Albizia littoralis* Teijsm. & Binnend., Nat. Tijds. Ned. Ind. 29 (1866) 259.

*Albizia julibrissin* auct. non Durazz.: Miq., Fl. Ind. Bat. 1 (1855) 28, p.p., quoad Banda specim. (as var. *mollis*).

**Distribution** – Japan (Ryukyu Islands), Thailand (Peninsular), Australia (Queensland), New Hebrides, Micronesia, Carolines; throughout *Malesia*.

#### KEY TO THE SUBSPECIES

- 1a. Rachis and pinnae with a few scattered hairs or sparsely puberulous; leaflets drying green or greenish above. Calyx glabrous to appressed puberulous . . . . . **a. subsp. *retusa***
- b. Rachis and pinnae densely short-pubescent, glabrescent; leaflets drying lead-grey above. Calyx patently puberulous . . . . . **b. subsp. *morobei***

#### **a. subsp. *retusa***

Tree to 25 m high, d.b.h. 70 cm; bole short, often crooked, up to 3 m. Stipules filiform, c. 1.5 mm, caducous. *Leaves*: rachis 5–18 cm, with a gland c. 0.5 cm above the base, circular to elliptic, sessile, sometimes with slightly raised margins, 1–3 mm in diameter, and with a smaller but similar gland at the junction of the distal pair of pinnae; pinnae 2–4 pairs, 4–9 cm, with a gland at the junction of the 1–3 distal pairs of petiolules, circular, sessile, with raised margin, c. 0.5 mm in diameter; petiolule c. 1 mm; leaflets 4–10 pairs per pinna, opposite, chartaceous, unequal-sided, ovate to subrhombic, (0.6–) 2–3.5 by 1–2 cm, base asymmetrically cuneate, apex rounded, often mucronulate, main vein subcentral, both surfaces very sparsely puberulous or glabrous. *Inflorescence* composed of pedunculate corymbs aggregated into terminal, puberulous to tomentose panicles; peduncles 2–7;  $\pm$  fasciculate, 1.5–9 cm, corymbs 10–15-flowered, pedicel 2.5–5 mm. Flowers dimorphic. Calyx tubular to narrowly funnel-shaped, (1.5–) 2–3.5 mm, glabrous to appressed puberulous, teeth inconspicuous. Corolla white, narrowly funnel-shaped, (5–) 7–9.5 mm, tube glabrous or sparsely puberulous in the lower part, lobes 3–5,  $\pm$  unequal, broadly ovate-oblong, c. 2.5 mm, as the upper part of the tube densely appressed puberulous to sericeous. *Stamens* purple to pink, c. 15 mm, tube longer than the corolla tube but shorter than the corolla. Ovary 3–4 mm, glabrous, stipe 1–2 mm. *Pod* yellowish, straight, flat, oblong, rounded at both ends, 14–22 by 2.8–3.5 cm, indehiscent, breaking up irregularly; valves with strongly thickened margins, chartaceous, gla-

brous, strongly bullate over the seeds, veins hardly distinct, reticulate. *Seeds* brown, narrowly elliptic to narrowly ovate-elliptic in outline, biconvex, 7–9 by 3.5–4.5 by 1.5 mm, areole 5 by 1–1.5 mm, pleurogram parallel to the margins, open towards the hilum.

Distribution — As the species.

Habitat & Ecology — Mostly on off-shore islands, sandy beaches, mangrove; lowland rain forest subject to flooding; also recording from coral sand; altitude 500(–900) m. Fl. Feb.–May, Aug.; fr. Aug.

Field notes — Bark brownish grey, smooth, inner bark yellow; sapwood yellowish brown, heartwood dark brown.

Note — Specimens in New Guinea may vary by narrow leaflets and small flowers [see Nielsen, *Opera Bot.* 81 (1985) 30].

**b. subsp. morobei** Nielsen, *Opera Bot.* 81(1985) 31, f. 13. — *Albizia* 'sp. B' Verdc., *Manual New Guin. Legum.* (1979) 193.

Differing from subsp. *retusa* in the following aspects: Tree to 39 m high; bole straight, 18 m. *Leaves*: rachis and pinnae densely shortly pubescent, glabrescent; leaflets drying lead-grey above, densely to sparsely appressed puberulous beneath. Calyx narrowly funnel-shaped, c. 1.5 mm, patentely puberulous. Corolla funnel-shaped, (4–)5 mm, densely sericeous to hirsute. *Pod* (not seen ripe) yellowish green to yellowish grey, 10–16 by 2–2.8 cm, with only slightly thickened margins, densely transversely reticulate. *Seeds* irregular, flattened, 4.5–6 by c. 5 mm; areole irregular, ± elliptic oblong, 3.5–4.5 by 1.5–2 mm, pleurogram ± parallel to the margins, open towards the hilum.

Distribution — *Malesia*: Papua New Guinea (Morobe and Western Highlands Prov.).

Habitat & Ecology — Rain forest, secondary regrowth on alluvial soil; altitude 370–810 m. Fr. May, Dec.

Field notes — Bark light grey to greenish grey, smooth, except for a few shallow cracks and pustules arranged in horizontal lines; inner bark straw-coloured, hard, non-fibrous; wood moderately hard and heavy, sapwood straw, heartwood red-brown.

Uses — The seeds have been seen used as beads.

**15. Albizia rosulata** (Kosterm.) Nielsen, *Opera Bot.* 81 (1985) 46, f. 22: 7–11, f. 16. — *Pithecellobium rosulatum* Kosterm., *Reinwardtia* 3 (1954) 3, f. 3; Cockb., *Trees Sabah* 1 (1976)

197, f. 43. — *Parenterolobium rosulatum* (Kosterm.) Kosterm., *Bull. Organ. Natuurw. Onderz. Indon.* 20 (1954) 19, f. 3, 14; *Adansonia* sér. 2, 6 (3) (1966) 361.

*Pithecellobium landakense* Kosterm., *Reinwardtia* 3 (1954) 3, f. 2, p.p. — *Parasamanea landakensis* (Kosterm.) Kosterm., *Bull. Organ. Natuurw. Onderz. Indon.* 20 (1954) 11, f. 2, p.p., excl. fruct.

Distribution — *Malesia*: Borneo.

#### KEY TO THE SUBSPECIES

1a. More than 40 flowers per corymb. Calyx obconical, glabrous, 4 mm. Corolla narrowly funnel-shaped, glabrous, 10 mm

a. subsp. **rosulata**

b. Up to c. 25 flowers per corymb. Calyx cup-shaped, puberulous at the apex, 1.5–2.5(–3) mm. Corolla funnel-shaped, puberulous at the distal parts of the lobes, 5–8(–9) mm

b. subsp. **landakensis**

a. subsp. **rosulata**

Only known from the fragmentary type-collection, which consists of leaflets and flowering peduncles. For description of the leaflets see subsp. *landakensis*.

Corymbs with more than 40 flowers. Calyx obconical, glabrous, 4 mm. Corolla narrowly funnel-shaped, glabrous, 10 mm.

Distribution — *Malesia*: Borneo (W Kalimantan, K. Kapuas).

**b. subsp. landakensis** (Kosterm.) Nielsen, *Opera Bot.* 81 (1985) 47. — *Pithecellobium landakensis* Kosterm., *Reinwardtia* 3 (1954) 3, f. 2, p.p.

Tree to 40 m high, d.b.h. to 65(–90) cm; low buttresses often present. Branchlets terete, puberulous in the ultimate parts, glabrescent. Stipules triangular, acute, rigid, to c. 1 mm, caducous. *Leaves*: petiole 0.9–2.5 cm, short-puberulous, glabrescent, with a gland c. 1 mm below the junctions of the pinnae, subsessile or raised, rimmed, concave, when narrow with an orifice, 0.5–1.2 mm in diameter; pinnae 1 pair, puberulous, glabrescent, 6–18.5 cm, with glands at the junctions of the petiolules, stalked, narrower but in other aspects similar to the petiolar gland; petiolules 2–6 mm, puberulous, glabrescent; leaflets (2–)3–4 pairs per pinna, (sub)opposite, chartaceous, ± unequal-sided, ovate to oblong, (3–)4–15 by 1.7–6.3



cm, glabrescent, or lower surface with scattered glandular hairs; base  $\pm$  symmetrically cuneate, apex acuminate; main vein central or subcentral. *Inflorescence* composed of pedunculate solitary corymbs, placed in the axils of the developing leaves or on short lateral branchlets developing simultaneously with the leaves; peduncles 1.8–5.5 cm, densely puberulous, corymb consisting of up to c. 25 pedicellate flowers. *Flowers* dimorphic, pentamerous, bisexual; pedicel 3–5(–8.5) mm. Calyx green or pale green, cup-shaped, 1.5–2.5(–3) mm, teeth triangular, acute, to 0.5 mm, puberulous at the apex. Corolla pale green or greenish white, funnel-shaped, glabrous at base, 5–8(–9) mm; lobes oblong, acute, puberulous toward the top, 1.5–2.5(–3.5) mm. *Stamens* white, c. 20 mm, tube equalling the corolla-tube. Ovary sessile, glabrous, c. 3 mm. *Pod* black or brownish black, woody, curved into a circle, c. 10 cm in diameter, ventral suture forming the outer margin, segmented, segments 1-seeded, subtriangular, c. 2–3 cm wide in the outer part, glabrous, indehiscent, the pod falling apart in segments. *Seeds* brown-black, ovoid, often irregularly shaped, flattened, c. 16–19 by 14–17 by 7–8 mm; areole horseshoe-shaped, continuous between both faces of the seed, c. 1–2 mm wide, closed, central part of seed with a cracked testa.

Distribution – *Malesia*: Borneo.

Habitat & Ecology – Primary rain forest on sandy loam soil, sandy clay, in kerangas, peat-swamp forest, or riverine forest; locally said to be common on top and upper slopes of ridges; altitude c. 0–100(–750) m. Fl. Apr.–Sep.; fr. Aug.–Oct., Feb.–Mar.

Field notes – Buttresses often present, low and rounded to 30 by 30 cm; bark usually rough, brown to blackish, peeling off irregularly in rather large pieces, mottled yellow and black. Inner bark red to brown. Sapwood ochre to pale yellowish white or white; heartwood blackish brown, streaked.

Note – For taxonomic information, see Nielsen, l.c.

**16. *Albizia rufa*** Benth., Lond. J. Bot. 3 (1844) 101; Backer & Bakh. f., Fl. Java 1 (1963) 553; Nielsen, Opera Bot. 81 (1985) 46, f. 26. — *Acacia rufa* (Benth.) Hassk., Hort. Bogor. Descr. (1858) 290.

Climber or trailing shrub, up to 10 m. Branchlets terete, reddish tomentose in the distal parts, glabrescent, armed by recurved prickles, 0.5–1.5 cm, each emerging from the bases of the leaf-scars, caducous. Stipules lanceolate-linear, caducous, c. 3

by 1 mm, reddish tomentose. *Leaves*: rachis 9–16 cm, puberulous, with a gland 0.2–0.6 cm above the base, circular, raised, convex, c. 1.5 mm in diameter; pinnae 5–7 pairs, 3–8.5 cm, with glands just below the junctions of the petiolules of the 2–4 distal pairs of leaflets, elliptic, c. 0.2–0.5 mm; leaflets 5–14 pairs per pinna, opposite, petiolule 0.5–1 mm, chartaceous, oblong to obovate or subtrapezoid, unequal-sided, base half cuneate/half rounded or  $\pm$  cuneate, apex rounded to obtuse, nearly always with a triangular cuspid; both surfaces laxly appressed puberulous; main vein  $\pm$  diagonal. *Inflorescences* composed of pedunculate glomerules aggregated into terminal, red-brown tomentose-flocculose panicles, peduncles solitary or a few together, 0.7–2 cm, with glomerules of 15–25 sessile flowers. *Flowers* dimorphic, tetramerous or pentamerous, bisexual. Calyx shortly obconical, 1.2 mm, hirsute by semipatent hairs; teeth inconspicuous, triangular, acute, 0.2 mm. Corolla greenish white, narrowly funnel-shaped, 4–5 mm, hirsute (by semipatent hairs); lobes lanceolate-oblong, c. 1.5 mm, obtuse. *Stamens* few, c. 12–20 mm, white (or pink in the proximal part), tube equalling the corolla-tube. Ovary c. 1 mm, with a few curly hairs, stipe c. 1 mm. *Pod* brown, oblong, straight, flattened, thinly chartaceous, 10–20 by 2–4 cm, dehiscing along both sutures, glabrous, slightly swollen over the seeds, with inconspicuous, transverse veins. *Seeds* ovate-oblong, strongly flattened, c. 8 by 5 mm; areole  $\pm$  oblong, 6.5 by 2.5 mm, pleurogram parallel to the margins of the seed, open towards the hilum.

Distribution – *Malesia*: W Java.

Habitat & Ecology – Secondary forest, forest-margins, ravines, roadsides, also recorded from limestone; altitude 50–600 m.

**17. *Albizia saponaria*** (Lour.) Blume ex Miq., Fl. Ind. Bat. 1 (1855) 19; Whitm., Tree Fl. Malaya 1 (1972) 280; Cockb., Trees Sabah 1 (1976) 185; Verdc., Manual New Guin. Legum. (1979) 191; Nielsen, Adansonia sér. 2, 19 (2) (1979) 222; Nielsen, Opera Bot. 81 (1985) 32, f. 15. — *Mimosa saponaria* Lour., Fl. Cochinch. (1790) 653; ed. Willd. (1793) 802. — *Inga saponaria* (Lour.) Willd., Sp. Pl. 4 (1806) 1008; DC., Prod. 2 (1825) 440.

*Albizia salajeriana* Miq., Fl. Ind. Bat. 1 (1855) 21. — *Albizia tomentella* Miq. var. *salajeriana* (Miq.) Koord., Meded. Lands Pl. Tuin 19 (1898) 427, p.p., quoad nomen.

*Abarema nediana* Kosterm., Gard. Bull. Sing. 17 (1958) 8.

## KEY TO THE VARIETIES

- 1a. Leaflets appressed puberulous beneath,  $\pm$  acuminate ..... **a. var. *saponaria***  
 b. Leaflets patently puberulous to velutinous beneath; apex broadly rounded

**b. var. *velutina*****a. var. *saponaria***

Tree to 15(–24) m high, d.b.h. up to 75 cm. Branchlets terete, densely puberulous to tomentellous with reddish brown circular lenticels. Stipules oblong-lanceolate to linear, 3.5–10 by 0.8–3 mm, (early) caducous. *Leaves*: rachis (2.5–)5–14.5(–19) cm, densely puberulous, with a gland 0.3–1.7 cm above the base, circular to elliptic in outline, slightly concave, 1–2.5 mm in diameter; pinnae 1 or 2 (or 3) pairs, the proximal pair most often reduced, 0.8–5.5 cm with 1 or 2 pairs of leaflets, distal pair 5.3–11.5 cm, with 2 or 3 (or 4) pairs of leaflets; petiolules 2–4 mm; leaflets opposite, thinly coriaceous, ovate(–elliptic) or broadly obovate,  $\pm$  unequal-sided, (1–)2.4–11.5(–13) by (1.3–)2.3–7.5 cm, base broadly cuneate to rounded; apex obtuse or rounded, acuminate, rarely mucronulate, upper surface glabrous, lower surface  $\pm$  densely appressed puberulous, main vein  $\pm$  central. *Inflorescence* composed of pedunculate glomerules aggregated into terminal, puberulous or tomentellous panicles, peduncles to 3 cm long, glomerules consisting of 12–20 sessile flowers. *Flowers* dimorphic, bisexual, creamy-yellow, pentamerous. Calyx obliquely campanulate, rarely tubular or cup-shaped, (1–)1.5–2.5 mm, densely appressed puberulous to sericeous; teeth triangular, acute, 0.2(–0.5) mm. Corolla broadly funnel-shaped, (4.5–)5–6(–7.1) mm, densely appressed puberulous or sericeous, lobes ovate to oblong lanceolate, 1.5–2.5 mm. *Stamens* creamy-white, tube usually exceeding the corolla tube but always shorter than the corolla. Ovary c. 1–2 mm, style to 1 mm. *Pod* reddish brown or grey-brown when dry, oblong, with sinuate margins, flattened, chartaceous 11–20 by (2.5–)3.5–4 cm, dehiscent, valves scattered-puberulous, glabrescent, with prominent densely reticulate transverse veins which are raised over the seeds. *Seeds* brownish, elliptic to ovate-elliptic, flattened, 7–10 by 4–6 by c. 1 mm, areole 5–8 by 2–2.5 mm with pleurogram parallel to the margins, open towards the hilum.

*Distribution* – *Malesia*: Borneo (islands off Sabah, Lahad Datu Dist.), Philippines, Celebes, Sula Archipelago, Moluccas (Ternate, Halmahera, Ceram, Ambina). Widely cultivated.

*Habitat & Ecology* – Secondary forest, open

forest open terrain, roadsides, sea-shore; recorded from both moist and dry soil, limestone; altitude sea-level up to 1050 m but most records from low altitudes. Fl. Apr.–Dec., fr. Jan.–Mar., May–Aug., Oct.–Nov.

*Field notes* – Bark smooth, grey, but it may appear reddish brown due to the very numerous, laterally elongated lenticels; sapwood soft, white, easy to cut and to split.

*Uses* – Because of the considerable saponin-content of the bark and wood used as a substitute for soap and as fish-poison [cf. Burkill, Dict. 1 (1935) 83, 84].

**b. var. *velutina*** Nielsen, Opera Bot. 81 (1985) 33, f. 14, 15: 5–7.

*Albizia tomentella* Miq. var. *salajeriana* auct. non (Miq.) Koord.: Koord., Meded. Lands Pl. Tuin 19 (1898) 427, p.p., quoad *Koorders 17545/17551*.

Tree 30(–42.5) m high, d.b.h. 48 cm. *Leaves*: rachis 8–16.5 cm, shortly tomentose; leaflets ovate, elliptic to obovate-elliptic, or broadly obovate, 3.5–14 by 2.5–10.5 cm; apex broadly rounded, indistinctly (acuminate-)mucronulate; lower surface patently puberulous to velutinous, sometimes with semipatent hairs only. Calyx 1.8–2.5 mm. Corolla 5–6 mm. *Pod* 10–22 by 2.7–5 cm.

*Distribution* – *Malesia*: Philippines (Mindanao), Celebes, Moluccas (Ceram, Morotai).

*Habitat & Ecology* – Primary and secondary rain forest; recorded also from volcanic soil and coral rocks; altitude sea-level up to 860 m. Fl. Feb.–Mar., May–June, Aug.–Sep.; fr. Mar., Aug.

*Uses* – As var. *saponaria*.

**18. *Albizia splendens*** Miq., Sumatra (1861) 280; Nielsen, Adansonia sér. 2, 19 (2) (1979) 211; Opera Bot. 81 (1985) 46, f. 27. — *Pithecellobium splendens* (Miq.) Corner, Wayside Trees 1 (1940) 421; Whitm., Tree Fl. Malaya 1 (1972) 287; Cockb., Trees Sabah 1 (1976) 198, f. 43. — *Serialbizzia splendens* (Miq.) Kosterm., Bull. Organ. Natuurw. Onderz. Indon. 20 (1954) 17, f. 12, 13; Adansonia sér. 2, 6 (3) (1966) 361. *Pithecellobium confertum* Benth., Trans. Linn. Soc. 30 (1875) 577.

Tree to 30(–50) m, rarely buttressed; d.b.h. to 100 cm. Branchlets slightly angled to terete, glabrous, dark brown, often with transverse fissures when dry. Stipules not seen. *Leaves*: petiole 1–3 cm, puberulous, glabrescent, with a gland at the

junctions of the pinnae, circular to oblong or obtriangular, sessile, usually sunken in the rachis and with raised margins, c. 4–7 mm; pinnae 1 pair, 2–6.5 cm, puberulous, glabrescent, with a gland at the junction of the distal pair of petiolules, obovate-obtriangular, sunken, with raised margins, 2–3 mm; petiolules 3 mm; leaflets 1–3 pairs per pinna, rigidly chartaceous, opposite, unequal-sided, ovate, elliptic to obovate-elliptic, 5.5–11(–17) by 3.5–5.5(–11) cm, base  $\pm$  asymmetrically cuneate to rounded, apex obtusely acuminate; both surfaces glabrous except for the sparsely puberulous main vein which is central or subcentral. *Inflorescences* composed of pedunculate glomerules, on nude branchlets below the leaves or in the upper leaf-axils; peduncles to 2 cm, puberulous, often in fascicles of 4 or 5, aggregated into puberulous short panicles; glomerules consisting of c. 15 flowers. *Flowers* subsessile, dimorphic, pentamerous, bisexual. Calyx greenish white, subtubular, 2–2.5 mm, sparsely appressed puberulous, often unilaterally divided to the base; teeth inconspicuous, triangular, 0.2 mm. Corolla greenish white, narrowly funnel-shaped, 6–8 mm, glabrous or lobes puberulous at apex; lobes elliptic or elliptic-oblong, acute, 2.5–3 mm. *Stamens* white, tube equalling the corolla-tube. Ovary sessile, c. 3 mm, glabrous. *Pod* black or blackish brown, straight or slightly curved, often slightly twisted, rigidly chartaceous-subcoriaceous, flat, sometimes slightly constricted between the seeds, glabrous, c. 18–30 by 3.5–5 cm, indehiscent, valves not conspicuously bullate over the seeds, which are held in separate, externally visible chambers. *Seeds* brown, often irregular on shape, ovoid to broadly ellipsoid(-obovoid), biconvex, c. 13–16 by 10–14 by 4–5.5 mm; areole horseshoe-shaped,  $\pm$  symmetrical, to 6 by 1.5 mm, usually reaching beyond the middle of the seed and usually not continuous between the faces of the seed, closed.

*Distribution* – Peninsular Thailand; *Malesia*: Malay Peninsula, Sumatra, Borneo (Brunei, Sabah, Kalimantan).

*Habitat & Ecology* – Primary lowland rain forest, old secondary forest on ridges and steep hill-sides; altitude 0–700 m. Fl. Jan.–June, Nov.; fr. Feb., June, Oct. Seedlings with epigeal cotyledons and first leaf 2-pinnate.

*Field notes* – Bark whitish grey to black, closely reticulately fissured, shallow fissures with jagged edges formed of horizontally raised, corky plates; outer bark ochre, middle bark bright yellow, inner bark reddish brown. Sapwood light yellow; heartwood red-brown weathering to dark brown.

*Uses* – Hardwood, moderately hard and heavy, strong, without silica,  $\pm$  durable, seasons slowly without degrading. Suitable for furniture.

**19. *Albizia tomentella* Miq.**, Fl. Ind. Bat. 1 (1855) 20; Sumatra (1860) 105; Backer & Bakh. f., Fl. Java 1 (1963) 554; Nielsen, Opera Bot. 81 (1985) 35, f. 16.

*Distribution* – *Malesia*: Java, Lesser Sunda Islands (?Lombok, Alor, Sumbawa, Flores, Timor).

*Note* – In habit close to *A. saponaria*, but differing in essential characters as the form of the stipules, the number of pinnae and leaflets, and floral morphology (cf. Nielsen, l.c.).

#### KEY TO THE SUBSPECIES

- 1a. Apex of leaflets acute or shortly acuminate.  
Calyx (2.3–)3–4.5 mm, corolla (5.5–)7–9 mm ..... **a. subsp. *tomentella***
- b. Apex of leaflets rounded. Calyx 1.2–2.8(–3) mm, corolla 4.5–8 mm  
**b. subsp. *rotundata***

#### **a. subsp. *tomentella***

Shrub to medium-sized tree, to 21 m high; d.b.h. 0.37 m; bole to 11 m. Branchlets slightly angular. Stipules filiform, 2–3 by 0.3 mm, caducous. *Leaves*: rachis 7–22 cm, puberulous to shortly tomentose, with a gland 0.4–1 cm above the base, elliptic to slit-like, raised and concave, 3–4 mm; pinnae (2 or) 3 or 4 pairs, 2.5–11.5 cm, proximal pairs with 2 or 3 pairs of leaflets, distal pinnae with 4 or 5 pairs of leaflets; petiolules c. 2 mm; leaflets opposite, thinly coriaceous, subtrapezoid, ovate, obovate, or  $\pm$  rhomboid, unequal-sided, 1.6–10.5 by 0.9–7.3 cm; base more or less asymmetrically cuneate or rounded, apex acute or minutely acuminate; upper surface sparsely puberulous, lower surface (glabrous or) densely appressed puberulous; main vein diagonal or subcentral. *Inflorescences* composed of pedunculate glomerules aggregated in terminal, densely puberulous panicles; peduncles to 2 cm, glomerules with 10–15 sessile, uniform flowers. *Flowers* pentamerous. Calyx tubular or narrowly campanulate, (2.3–)3–4.5 mm, densely appressed puberulous; teeth triangular, acute, unequal, 0.5–1 mm. Corolla light green, narrowly funnel-shaped, (5.5–)7–9 mm, densely appressed puberulous-sericeous; lobes triangular-ovate to ovate-oblong, 2–2.5 mm. *Stamens* greenish white or white, tube exerted, c. 10 mm. Ovary sessile, glabrous. *Pod* red-brown when



Habitat & Ecology – Primary forest on sandy clay; altitude 174–450 m. Fl. Apr.; fr. Aug.

## EXCLUDED AND DUBIOUS

*Albizia amara* Boivin; Miq., Fl. Ind. Bat. 1 (1855) 25; Burkill, Dict. 1 (1935) 83, 84.

An African and Indian species not recorded from Malesia.

*Albizia julibrissin* Durazz., Mag. Tosc. 3, 4 (1772) 13; Miq., Fl. Ind. Bat. 1 (1855) 27, p.p. (as *A. julibrissin* Boivin); Nielsen, Opera Bot. 81 (1985) 48.

Native of warm temperate and subtropical Asia (Turkey to Japan), once cultivated in Bogor. Never naturalized (cf. Nielsen, l.c.).

*Albizia lucidior* (Steudel) Nielsen, Adansonia sér. 2, 19 (2) (1979) 222; Fl. Camb. Laos Vietnam 19 (1981) 86, pl. 15. — *Inga lucidior* Steudel, Nomencl. Bot. ed. 2, 1 (1840) 810. — *Mimosa lucida* Roxb., Fl. Ind. 2 (1832) 544, non Vahl

(1807). — *Albizia lucida* (Roxb. non Vahl) Benth., Lond. J. Bot. 3 (1844) 86; Miq., Fl. Ind. Bat. 1 (1855) 18; Zoll., Nat. Tijds. Ned. Ind. 13 (1857) 303; Koord., Exk. Fl. Java 2 (1912) 358; Burkill, Dict. 1 (1935) 83; Backer & Bakh. f., Fl. Java 1 (1963) 553.

Native of tropical mainland Asia (excl. Malaya), earlier cultivated in Malaya and Java. No recent collections.

*Albizia odoratissima* (L. f.) Benth., Lond. J. Bot. 3 (1844) 88; Burkill, Dict. 1 (1935) 83, 88; Corner, Wayside Trees 1 (1940) 411; Nielsen, Opera Bot. 81 (1985) 22. — *Mimosa odoratissima* L. f., Suppl. Pl. (1781) 437.

*Albizia micrantha* Boivin, Encycl. 19, 2 (1838) 33; Miq., Fl. Ind. Bat. 1 (1855) 24.

Native of the monsoon areas of mainland Asia. Known under the commercial name 'Ceylon Rosewood', tried in cultivation in Malaya (Corner, l.c.) but never naturalized.

## ARCHIDENDRON

*Archidendron* F. Muell., Fragm. 5 (1865) 59; Benth., Trans. Linn. Soc. 30 (1875) 600; De Wit, Bull. Bot. Gard. Buitenzorg 17, 2 (1942) 256; Reinwardtia 2 (1952) 71; Nielsen, Baretta-Kuipers & Guinet, Opera Bot. 76 (1984) 1.

*Pithecellobium* sect. *Archidendron* (F. Muell.) Mohlenbr., Reinwardtia 6 (1963) 446; Webbia 21 (1966) 656.

*Pithecellobium* sect. *Clypearia* Benth., Lond. J. Bot. 3 (1844) 206; Trans. Linn. Soc. 30 (1875) 570, p.p.

*Hansemannia* K. Schum., Bot. Jahrb. 9 (1887) 201.

*Ortholobium* Gagnep., Bull. Soc. Bot. Fr. 99 (1912) 36, nom. rejic.

*Cylindrokellupha* Kosterm., Bull. Organ. Natuurw. Onderz. Indon. 20 (1954) 20.

*Morolobium* Kosterm., l.c. 20.

*Paralbizzia* Kosterm., l.c. 23.

*Zygia* sensu Kosterm., l.c. 24.

*Abarema* sensu Kosterm., l.c. 31.

Unarmed shrubs or trees. Stipules present or not. *Leaves* bipinnate, rachis and pinnae with extrafloral nectaries; leaflets opposite, rarely alternate (3 species) or unifoliolate (2 species), petiolulate(-sessile). *Inflorescences* simple or compound, consisting of pedunculate glomerules, umbels, corymbs, or racemes, or, when the inflorescence is compound, maybe arranged in cauliflorous, ramiflorous, axillary, or terminal panicles. *Flowers* bisexual, sometimes male or female, or bisexual and male, (tri- or) pentamerous, uniform. Calyx connate, valvate. Corolla connate, valvate, tube united with the staminal tube in the lower part. *Stamens* numerous, at base united into a tube. Ovary(ies) 1–15 per flower, sessile or stipitate. *Pods* chartaceous, coriaceous, fleshy or woody, straight, curved, or

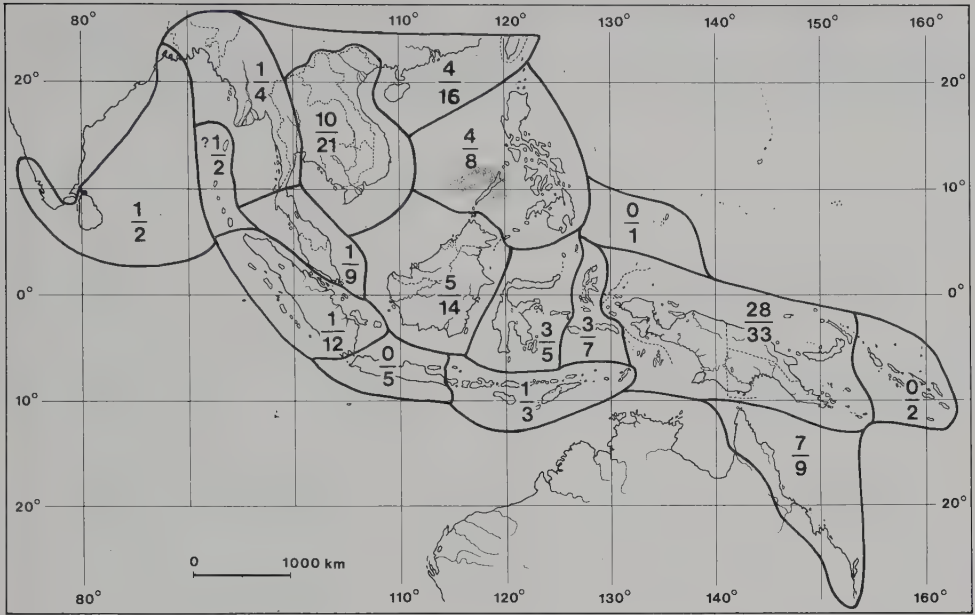


Fig. 12. Range of the genus *Archidendron* F. Muell. The figures above the hyphen indicate the number of endemic species, those below the hyphen indicate the total number of species.

spirally twisted, flat or terete, sometimes internally segmented, dehiscing along either the dorsal or the ventral suture, sometimes along both, often reddish outside and orange-reddish within; endocarp not forming envelopes around each seed. *Seeds* transversely held,  $\pm$  funiculate,  $\pm$  ellipsoid,  $\pm$  flattened, with a black or bluish-black testa, without pleurogram, wingless, aril absent; endosperm absent; cotyledons large; radicle curved. — **Figs. 13–18.**

**Distribution** — In all 94 species, in India, Ceylon, continental SE Asia, throughout *Malesia* (62 species) to NE Australia, 1 species extending to Micronesia, 2 species to the Solomon Islands. — Fig. 12.

**Habitat & Ecology** — Rain forest shrubs or trees, mainly at low altitudes (but sometimes up to c. 1800 m). Mostly recorded from primary and secondary lowland forest, a small number of species recorded from swampy habitats (*A. borneense*, *A. kunstleri*, *A. oppositum*). Most species are restricted to sandy or lateritic soil. Three species, *A. fagifolium*, *A. tjendana* and *A. palauense*, have been recorded from habitats with limestone, the latter from supralittoral habitats with coral-sand. Some species, e.g. *A. contortum*, *A. fagifolium* and *A. microcarpum*, are common understorey shrubs in the W Malesian area. Seeds are probably dispersed by birds.

**Morphology & Taxonomy** — The morphology of this genus is extensively reviewed by Nielsen, Baretta-Kuipers & Guinet (l.c.). Important characters for the subdivision of the genus are the morphology of the pods, the presence or absence of an extrafloral nectary on the floral bract, the morphology of the inflorescence, the length of the staminal



tube and presence or absence of an ovary stipe. See the keys to the series and the species (flowering or fruiting material). The genus has no obvious close relatives in the Old World, but is related to the genera *Cojoba* and *Zygia* from tropical Central and South America (Nielsen, Baretta-Kuipers & Guinet, l.c.).

KEY TO THE SERIES

- 1a. Petiole strongly two-winged ..... **5. Series Ptenopae** (p. 133)
- b. Petiole unwinged (pinnae winged in one species) ..... 2
- 2a. Pinnae unifoliolate ..... **6. Series Morolobiae** (p. 135)
- b. Pinnae each with two to several leaflets ..... 3
- 3a. Inflorescences consisting of lax and pendulous simple racemes or few-flowered umbels, or racemes aggregated into lax racemes, cauliflorous  
**7. Series Pendulosae** (p. 136)
- b. Inflorescences erect, consisting of pedunculate glomerules, corymbis, umbels, or racemes, either simple, or often aggregated into racemes or panicles ..... 4
- 4a. Calyx inflated at least at the mouth, membranous, and strongly longitudinally ribbed. Leaflets sessile, articulated into round pits similar to the pinna-glands  
**4. Series Calycinae** (p. 131)
- b. Calyx not inflated, not membranous, not strongly longitudinally ribbed. Leaflets usually petiolulate, if sessile then not jointed into pits similar to the pinna-glands . . . 5
- 5a. Flowers and pods subtended by bracts with a ring-shaped nectary  
**3. Series Stipulatae** (p. 121)
- b. Flowers and pods not subtended by bracts with a ring-shaped nectary ..... 6
- 6a. Flowers present ..... Key 1 { **1. Series Clypeariae** (p. 95)  
**2. Series Archidendron** (p. 115)  
**8. Series Bellae** (p. 138)
- b. Fruits present ..... Key 2 (p. 92) { **1. Series Clypeariae**  
**2. Series Archidendron**  
**8. Series Bellae**

KEY 1

Key to the species, based on flowering material of  
1. Series *Clypeariae*, 2. Series *Archidendron*, and 8. Series *Bellae*

- 1a. Branchlets angular or winged ..... 2
- b. Branchlets terete. .... 4
- 2a. Flowers grouped into corymbis or umbels; pedicel 1–3(–4) mm long ..... 3
- b. Flowers aggregated into glomerules, sessile or subsessile, pedicel up to 1 mm long  
**5. A. cockburnii**
- 3a. Leaflets sessile, chartaceous; main vein diagonal, lateral veins just visible beneath; lower surface puberulous or velutinous, papillose ..... **4. A. clypearia**

- b. Leaflets petiolulate, petiolule 2–5 mm long, coriaceous; main vein central or sub-central, lateral veins numerous, 7–14(–29), parallel, prominent and raised beneath; lower surface subglabrous, not papillose . . . . . **2. A. borneense**
- 4a. Ovary stipitate. Stipules and stipular glands absent . . . . . 5
- b. Ovary sessile. Stipules and/or stipular glands often present . . . . . 28
- 5a. Calyx shallowly cup-shaped to subrotate, c. 0.5 mm long . . . **17. A. microcarpum**
- b. Calyx cup-shaped, campanulate or funnel-shaped, or obconical, more than 1 mm long . . . . . 6
- 6a. Basic unit of inflorescence an umbel; pedicels 1.5–3 mm long . . . . . 7
- b. Basic unit of inflorescence a glomerule; pedicels 1 mm long . . . . . 8
- 7a. Petiolar gland(s) 3–11 mm long, narrowly elliptic to linear (or slit-like), flat or only slightly concave; lower surface of leaflets puberulous . . . . **14. A. kinabaluense**
- b. Petiolar gland(s) 2–4 mm long, urceolate or circular and concave, rarely linear-oblong with a central depression; lower surface of leaflets subglabrous with a few scattered hairs on the major veins and along the margins only . . . . **2. A. borneense**
- 8a. Petiolar gland deeply hollowed, with orifice pointing acroscopically . . . . . 9
- b. Petiolar gland urceolate, circular, elliptic-oblong, or slit-like . . . . . 10
- 9a. Calyx cup-shaped, 2–3 mm long. Corolla 6–7.5 mm long. Leaflets drying light green with yellowish brown veins, obliquely subcordate to ovate-elliptic, 11–27 by 7–16.5 cm . . . . . **7. A. crateradenum**
- b. Calyx cup-shaped or campanulate, 3–5 mm long. Corolla 7.5–12.5 mm long. Leaflets drying dark brown above and olive-green beneath, ovate, elliptic, obovate-elliptic or elliptic-lanceolate, 5.3–15(–22.5) by 1.4–6.4(–10) cm . . . . **16. A. merrillii**
- 10a. Petiolar gland urceolate . . . . . 11
- b. Petiolar gland circular, elliptic-oblong or slit-like . . . . . 12
- 11a. Ovary sericeous . . . . . **23. A. sabahense**
- b. Ovary glabrous . . . . . **12. A. havilandii**
- 12a. Ovary hairy . . . . . 13
- b. Ovary glabrous . . . . . 15
- 13a. Rachis-glands narrowly elliptic, oblong, or slit-like . . . . . 14
- b. Rachis-glands circular or broadly elliptic . . . . . **25. A. trichophyllum**
- 14a. Calyx 5–8.5 mm long. Corolla 13–20 mm long. Glands narrowly elliptic or oblong . . . . . **15. A. kunstleri**
- b. Calyx 1–1.5 mm long. Corolla 3.5–5.1(–5.5) mm long. Glands slit-like . . . . . **19. A. oppositum**
- 15a. Corolla glabrous all over . . . . . 16
- b. Corolla hairy at least at the lobes . . . . . 24
- 16a. Leaves with 5–10 pairs of pinnae, each with 10–22 pairs of leaflets . . . . . **6. A. contortum**
- b. Leaves with 1–3 pairs of pinnae, each with 1–5 pairs of leaflets . . . . . 17

- 17a. Leaves with (1 or) 2 or 3 pair(s) of pinnae; glands raised or with raised margins  
**9. A. fagifolium**
- b. Leaves with 1 (or 2) pair(s) of pinnae; glands sessile . . . . . 18
- 18a. Glands slit-like. . . . . 19
- b. Glands circular or elliptic . . . . . 20
- 19a. Leaflets glabrous. Calyx cup-shaped, 1.2–2.5 mm long, glabrous with ciliate teeth. Corolla 4–6 mm long. Flowers bisexual. Ovary solitary . . . **24. A. scutiferum**
- b. Leaflets scarcely puberulous beneath, with densely puberulous major veins. Calyx tubular-campanulate, 2.8–3.2 mm long, scarcely adpressed puberulous. Corolla 6–7.2 mm long. Flowers bisexual or male. Ovary(-ies) 1 or 2 per flower  
**1. A. apoense**
- 20a. Staminal tube shorter than or equalling the corolla-tube . . **26. A. triplinervium**
- b. Staminal tube longer than the corolla-tube . . . . . 21
- 21a. Inflorescences clustered on warted short-shoots below the leaves  
**22b. A. pauciflorum** var. **caulostachyum**
- b. Inflorescences terminal, above the leaves . . . . . 22
- 22a. Leaflets drying glossy bright green, with straw veins; primary lateral veins parallel, nearly straight. Calyx membranous, subtended by a 0.5–1 mm long elliptic-oblong bract . . . . . **21. A. palauense**
- b. Leaflets drying grey-green with brown veins, or dark green with chestnut veins; primary lateral veins arching, not parallel. Calyx chartaceous . . . . . 23
- 23a. Leaflets drying dark green above, green beneath with chestnut veins; leaflets widened acroscopically. Floral bract c. 1 mm long, broadly elliptic, obtuse. Calyx 2.5 mm. Corolla 6 mm . . . . . **10. A. falcatum**
- b. Leaflets drying grey-green with brown veins;  $\pm$  equal-sided, not widened acroscopically. Floral bract 0.5–0.8 mm long, ovate or ovate-elliptic, acute. Calyx 1.2–1.3 mm. Corolla 4–5.5 mm . . . . . **22a. A. pauciflorum** var. **pauciflorum**
- 24a. Staminal tube shorter than the corolla-tube . . . . . **11. A. globosum**
- b. Staminal tube equalling the corolla-tube . . . . . 25
- 25a. Corolla-tube glabrous . . . . . **13. A. jiringa**
- b. Corolla-tube puberulous or sericeous . . . . . 26
- 26a. Glomerules composed of 10–15 flowers. Petiolar gland sharply rimmed  
**20. A. pahangense**
- b. Glomerules consisting of 2–6 flowers. Petiolar gland not sharply rimmed . . . 27
- 27a. Glands of pinnae 3–4 mm long, obtriangular, flat. Corolla-tube sericeous  
**8. A. ellipticum**
- b. Glands of pinnae 0.5–1 mm in diameter, subglobose or circular, flat. Corolla-tube puberulous . . . . . **3. A. bubalinum**
- 28a. Basic unit of inflorescence a raceme . . . . . 29
- b. Basic unit of inflorescence a glomerule, a corymb, or an umbel . . . . . 35



- 29a. Inflorescence including calyx rusty tomentose ..... **62. A. rufescens**  
b. Inflorescence including calyx glabrous ..... 30  
30a. Corolla golden tomentellous ..... **61. A. forbesii**  
b. Corolla glabrous. .... 31  
31a. Corolla 27–45 mm long. Ovaries 2–5 per flower ..... 32  
b. Corolla 9–23 mm long. Ovaries 1 or 2 per flower ..... 33  
32a. Inflorescence a simple or scarcely branched raceme up to 3 cm long, glabrous. Corolla 40–45 mm long, tubular with recurved lobes ..... **28. A. beguinii**  
b. Inflorescence a once-branched panicle, up to 15 cm long, with lateral branches carrying the racemosely arranged flowers. Corolla 27–35 mm long, funnel-shaped with erect lobes ..... **59. A. bellum**  
33a. Pinnae 2 or 3 pairs; leaflets 4–7 pairs per pinna. Calyx 5–7 mm long, narrowly campanulate. Corolla 16–23 mm long, very narrowly funnel-shaped  
(3. Series *Stipulatae*) **43. A. gogolense**  
b. Pinnae 1 pair; leaflets c. 1–3 pairs per pinna. Calyx 3.5–5.5 mm long, subtubular or campanulate. Corolla 9–11 mm long,  $\pm$  tubular or funnel-shaped ..... 34  
34a. Petiole and pinnae without glands. Calyx subtubular .... **37. A. trifoliolatum**  
b. Petiole and pinnae with circular or elliptic glands, 1–3 mm in diameter. Calyx campanulate ..... **Archidendron sp.** (in obs. no.)  
35a. Petiolar glands narrowly conical, often hollow, 1–5 mm high **29. A. grandiflorum**  
b. Petiolar glands circular or elliptic, not raised ..... 36  
36a. Basic unit of inflorescence an umbel, occasionally a few flowers placed below the terminal ones; pedicels (1–)2–10 mm long ..... 37  
b. Basic unit of inflorescence a glomerule composed of sessile or subsessile flowers 40  
37a. Corolla tomentose or sericeous, at least in the distal part of the tube and the lobes  
**60. A. calliandrum**  
b. Corolla glabrous all over ..... 38  
38a. Pinnae 2–4 pairs; leaflets drying shining, yellowish green. Ovaries 2–6 per flower  
**32. A. lucyi**  
b. Pinnae 1 pair; leaflets drying dull grey-green. Ovary solitary ..... 39  
39a. Corolla 22.5–30 mm long. Peduncles 1–2 cm long ..... **30. A. harmsii**  
b. Corolla 9–12 mm long. Peduncles 1.7–6 cm long ..... **36. A. tjendana**  
40a. Lower surface of leaflets glabrous or subglabrous with scarcely puberulous primary and secondary veins ..... 41  
b. Lower surface of leaflets puberulous, pilose, or densely hirsute ..... 42  
41a. Corolla sericeous, 6–9 mm long. Ovary pilose ..... **27. A. arborescens**  
b. Corolla subglabrous, with a few scattered hairs towards the apex of the lobes, 11 mm long. Ovary glabrous ..... **34. A. novo-guineense**  
42a. Calyx 2–2.5 mm long ..... **31. A. kalkmanii**  
b. Calyx 5–6 mm long ..... **35. A. syringifolium**

## KEY 2

Key to the species, based on fruiting material of

1. Series *Clypeariae*, 2. Series *Archidendron*, and 8. Series *Bellae*<sup>1</sup>

- 1a. Branchlets angular or winged . . . . . 2
- b. Branchlets terete . . . . . 4
- 2a. Leaflets chartaceous, subsessile, with diagonal main vein; lateral veins just visible beneath; lower surface puberulous or velutinous, papillose . . . . **4. A. clypearia**
- b. Leaflets coriaceous, petiolulate, petiolule 2–5 mm long; main vein central or sub-central, lateral veins prominent and raised beneath, not papillose . . . . . 3
- 3a. Leaflets with 7–14(–20) lateral veins per side, parallel, oblique, straight; lower surface subglabrous, with a few scattered hairs on the major veins. Pod forming a circle or a rounded square, c. 3.5 cm in diameter, prior to dehiscence **2. A. borneense**
- b. Leaflets with 6–10 lateral veins per side, not parallel, arching; lower surface puberulous. Pod spirally contorted, 14–25 by 1.5–2.2 cm . . . . . **5. A. cockburnii**
- 4a. Pods straight or slightly curved, usually sausage-shaped . . . . . 5
- b. Pods curved into a half or full circle, or spirally contorted, not sausage-shaped . 10
- 5a. Valves reddish or orange inside. Petiolar glands not urceolate . . . . . 6
- b. Valves grey or brownish inside. Petiolar gland (sub)urceolate **12. A. havilandii**
- 6a. Fruits borne on the old wood; pods large and sausage-shaped, c. 15–50 by 4–8.5 cm (8. Series *Bellae*) . . . . . 7
- b. Fruits terminal on twigs; pods smaller, up to 3 cm wide . . . . . 8
- 7a. Basic unit of infructescence a raceme (i.e., scars of pedicels evenly distributed along the inflorescence [axis]) . . . . . **59. A. bellum**
- b. Basic unit of infructescence an umbel (i.e., scars of pedicels aggregated at the end of the peduncle) . . . . . **60. A. calliandrum**
- 8a. Pod usually slightly flattened, densely puberulous when young, subglabrous and yellowish outside at maturity, 3.5–10 by 1.5–2.5 cm. Central seeds disc-like  
**3. A. bubalinum**
- b. Pod only slightly flattened, glabrous, bright red to reddish brown at maturity, 4.5–18 by 1.5–2.5 cm. Central seeds ellipsoid, but occasionally truncate in the parts adjacent to other seeds . . . . . 9
- 9a. Pods bright red outside at maturity, 4.9–9 by 1.7–2.5 cm . . . . **30. A. harmsii**
- b. Pods reddish brown outside at maturity, 13–18 by 1.8–2 cm . **36. A. tjendana**
- 10a. Seeds imbedded in a ± fleshy coriaceous pericarp giving the pod a segmented appearance internally, dehiscent along the sinuate dorsal suture (2. Series *Archidendron*) . . . . . 11
- b. Seeds not imbedded in a fleshy pericarp; pod sinuate along the ventral suture, dehiscing either first along the ventral suture or along both sutures simultaneously (1. Series *Clypeariae*, for the greater part) . . . . . 15

<sup>1</sup>) Pods unknown or insufficiently known in 1. *A. apoense*, 7. *A. crateradenum*, 14. *A. kinabaluense*, 31. *A. kalkmanii*, 34. *A. novo-guineense*, 35. *A. syringifolium*, and 37. *A. trifoliolatum*.

- 11a. Petiolar glands narrowly conical, often hollow, 1–5 mm high . . . . . **29. A. grandiflorum**
- b. Petiolar glands circular or elliptic in outline, not raised . . . . . 12
- 12a. Pods muricate by blunt, protruding tubercles . . . . . **33. A. muricarpum**
- b. Pod smooth outside. . . . . 13
- 13a. Pods tomentose outside . . . . . **27. A. arborescens**
- b. Pods glabrous outside . . . . . 14
- 14a. Pod slightly curved or curved into a circle, c. 10 by 2–3 cm . . . . . **32. A. lucyi**
- b. Pod densely contorted, c. 24 by 3 cm wide across the seeds . . . **28. A. beguinii**
- 15a. Petiolar gland deeply hollowed, with the orifice pointing forwards<sup>1</sup> . . . . . **16. A. merrillii**
- b. Petiolar gland circular, urceolate, elliptic, oblong or slit-like, when with orifice then not directed forwards. . . . . 16
- 16a. Pods rugulose or wrinkled outside. . . . . 17
- b. Pods smooth outside. . . . . 18
- 17a. Pod glabrous . . . . . **20. A. pahangense**
- b. Pod tomentose outside<sup>2</sup> . . . . . **27. A. arborescens**
- 18a. Valves of pods woody, sinuate for about halfway or more along the dorsal suture, distinctly contracted between the seeds . . . . . 19
- b. Valves of pods chartaceous or coriaceous, rarely woody, not or only slightly sinuate . . . . . 21
- 19a. Petiolar gland circular, convex (subglobose) or flat . . . . . **13. A. jiringa**
- b. Petiolar gland slit-like, sunken . . . . . 20
- 20a. Petiole hollow; leaflets drying greenish with yellowish brown veins, very broadly ovate-elliptic with rounded base . . . . . **18. A. minahassae**
- b. Petiole solid; leaflets drying dark green to blackish above and light green to lead-grey beneath, ovate-elliptic to broadly elliptic or lanceolate, with symmetrically cuneate base . . . . . **24. A. scutiferum**
- 21a. Pods hairy . . . . . 22
- b. Pods glabrous . . . . . 24
- 22a. Foliar glands urceolate with a narrow orifice . . . . . **23. A. sabahense**
- b. Foliar glands circular or elliptic . . . . . 23
- 23a. Leaflets 10–22 pairs per pinna . . . . . **6. A. contortum**
- b. Leaflets 2–4 pairs per pinna . . . . . **25. A. trichophyllum**
- 24a. Two kinds of pods in the infructescence: the marginal ones smaller and sterile, the central ones larger and fertile, c. 2–3 cm long, 0.5–1.5 cm wide . . . . . **17. A. microcarpum**
- b. Only one kind of pods in the infructescence . . . . . 25
- 25a. Leaflets with 8–14(–20) parallel, raised, straight, oblique lateral veins . . . . . 26
- b. Leaflets with arching and usually non-parallel, primary lateral veins. . . . . 29

1) 7. *A. crateradenum*, not yet known in fruit, will probably key out here.

2) 34. *A. novo-guineense*, not yet known with ripe fruits, will probably key out here.



26a. Infructescence borne below the leaves on old wood

**22b. *A. pauciflorum* var. *caulostachyum***

b. Infructescence terminal on branchlets . . . . . 27

27a. Leaflets chartaceous, drying bright green with straw veins. Pods loosely twisted into a spiral, c. 15–20 by 1.8–2.4 cm. Seeds 16 by 12 by 10 mm **21. *A. palauense***

b. Leaflets coriaceous to chartaceous, drying grey-green to dark brown. Pods densely contorted into a circle, c. 3.5–4.5 cm in diameter. Seeds c. 6–9 by 5–7 by 3–4 mm . . . . . 28

28a. Foliar glands urceolate or concave, circular or sometimes linear-oblong. Stalk of pod articulate. Seeds ellipsoid . . . . . **2. *A. borneense***

b. Foliar glands slit-like. Stalk of pod not articulate (flowers sessile). Seeds suborbicular . . . . . **19. *A. oppositum***

29a. Primary lateral veins (1–)2–3(–4) per leaflet-half; lateral veins issuing in the proximal part of the leaflet, arching to the apex . . . . . **26. *A. triplinervium***

b. Primary lateral veins (4 or) 5 or more per leaflet, issuing  $\pm$  equally along the main vein, not arching to the apex . . . . . 30

30a. Pods large, usually with valves more than 2 cm wide across the seeds. Seeds more than 17 mm long . . . . . 31

b. Pods smaller, usually with valves less than 2 cm wide across the seeds. Seeds ellipsoid, 17–21 by 10–11 mm . . . . . 34

31a. Leaflets with minute, reddish, sessile glandular hairs on the lower surface, especially close to the main vein (lens!); petiolar gland circular or semiglobose . . . . . 32

b. Leaflets without glandular hairs; glands flat and either circular, oblong, rhomboid, or obtriangular, often obtriangular on the pinnae . . . . . 33

32a. Leaflets densely appressed puberulous with hirsute veins beneath

**25. *A. trichophyllum***

b. Leaflets scarcely puberulous or glabrous beneath . . . . . **24. *A. globosum***

33a. Foliar glands circular or transversely elliptic. Pod woody, large, falcate, 7–13 by 2–3.3 cm. Seeds subglobose or very broadly ellipsoid, 20–22 by 18–20 by 14–20 mm . . . . . **10. *A. falcatum***

b. Foliar glands either oblong, rhomboid, or obtriangular. Pod coriaceous, curved into a circle, 4.5–8 cm in diameter, 2–3.5 cm wide across the seeds. Seeds ellipsoid, 17–21 by 10–11 mm . . . . . **8. *A. ellipticum***

34a. Leaves with (1 or) 2 or 3 pairs of pinnae. Pods coriaceous, usually found below the leaves . . . . . **9. *A. fagifolium***

b. Leaves with 1 (or 2) pair(s) of pinnae only. Pods chartaceous to coriaceous, found above the leaves . . . . . 35

35a. Rachis-glands oblong-elliptic, 2.5–6 mm. Seeds 12–15 mm long

**15. *A. kunstleri***

b. Rachis-gland 1, broadly elliptic or circular, 1–3 mm. Seeds 8–9 mm long

**22a. *A. pauciflorum* var. *pauciflorum***

### 1. Series *Clypeariae*

*Archidendron* ser. *Clypeariae* Nielsen, Opera Bot. 76 (1984) 38. — *Pithecellobium* sect. *Clypearia* Benth., Lond. J. Bot. 3 (1844) 206, p.p.; Trans. Linn. Soc. 30 (1875) 570, p.p.

Stipules, stipular scars and stipular glands absent. Petiole not winged. Leaflets opposite (in Malesia), rarely alternate, usually petiolulate. *Inflorescences* erect, terminal or axillary at the distal leaves, rarely ramiflorous below the leaves, consisting of panicles; inflorescence-unit consisting of umbels, corymbs or, usually, glomerules; floral bracts without nectary. *Flowers* bisexual, rarely male and female. Calyx neither inflated nor strongly ribbed. Staminal tube shorter than or equalling, rarely longer than the corolla-tube. Ovaries 1 or 2 per flower, stipitate (in Malesia). *Pods* coriaceous, chartaceous or woody, usually spirally contorted, sometimes sinuate along the ventral suture, dehiscing first along the ventral suture or simultaneously along both sutures. *Seeds* not imbedded in the pericarp.

Distribution — About 51 species, in India (3 or 4), Burma, Thailand, S China, Indo-China (c. 30), Micronesia (Carolines, 1), Solomon Islands (1); in *Malesia* 26 species, mainly in West Malesia.

Morphology & Taxonomy — Extensively reviewed by Nielsen, Baretta-Kuipers & Guinet [Opera Bot. 76 (1984) 5–120]. Species of series *Clypeariae* were formerly referred to the genera *Abarema*, *Cylindrokelupha*, *Paralbizzia* and *Zygia* by Kostermans [Bull. Organ. Natuurw. Onderz. Indon. 20 (1954)].

Note — For the Keys to the species (1: flowering, and 2: fruiting material), see p. 88 and p. 92, respectively.

**1. *Archidendron apoense*** (Elmer) Nielsen, Opera Bot. 76 (1984) 46, f. 18. — *Pithecellobium apoense* Elmer, Leaflet. Philipp. Bot. 2 (1910) 694; Merr., Enum. Philipp. 2 (1923) 242. — *Zygia apoensis* (Elmer) Kosterm., Bull. Organ. Natuurw. Onderz. Indon. 20 (1954) 31.

Tree, trunk to c. 10 m high, to 25 cm in diameter. Branchlets terete, brownish grey, lenticellate, puberulous. *Leaves*: petiole 2.7–3.8 cm, puberulous, glabrescent, gland slit-like, not raised, 4–6 mm long; pinnae 1 pair, 4–10 cm, densely puberulous, glabrescent; petiolules 5–7 mm, puberulous; leaflets 2 pairs per pinna, the lower pair subopposite or alternate, coriaceous or rigidly chartaceous, drying light brown or grey-brown,  $\pm$  unequal-sided, ovate-elliptic, broadly elliptic, or lanceolate, 11–23.5 by 5.3–12 cm, base symmetrically cuneate or slightly attenuate, apex acute(-acuminate), principal lateral veins 5–10 per leaflet-half, oblique, nearly straight, the lower ones not reaching

beyond the middle of the leaflet; reticulation prominulous above, prominent beneath, upper surface subglabrous except for the scarcely puberulous major veins, lower surface scarcely puberulous with densely puberulous major veins. *Inflorescences* ramiflorous, axillary at the leaves or terminal, puberulous to sericeous, consisting of pedunculate glomerules or spikelets, aggregated into panicles to 20 cm long; glomerules or spikelets composed of up to 15 subsessile flowers (pedicel c. 0.7 mm); bracts not observed. *Flowers* pentamerous, male or female. Calyx light green, tubular campanulate, 2.8–3.2 mm long, scarcely appressed puberulous, teeth irregularly triangular, acute, 0.1–0.5 mm long. Corolla creamy white, funnel-shaped, 6–7.2 mm long, tube glabrous; lobes elliptic, acute, 2–3 mm long, puberulous along margins and apex. *Stamens* creamy white, length not known, tube 4–4.8 mm, longer than the corolla-tube. Ovaries 1 or 2 per flower, glabrous. Pod and seeds unknown.

Distribution — *Malesia*: Philippines (Mt Apo, Mindanao).

Habitat & Ecology – Humid montane forest; altitude 1100–1350 m.

Field notes – Bark yellowish or greyish on the branches; sapwood white, coarsely grained, molasses brown towards the centre.

**2. *Archidendron borneense*** (Benth.) Nielsen, Opera Bot. 76 (1984) 58, f. 29, 30. — *Pithecellobium borneense* Benth., Trans. Linn. Soc. 30 (1875) 579; Merr., Enum. Born. (1921) 292; Cockb., Trees Sabah 1 (1976) 195. — *Feuilleea borneense* (Benth.) O. Kuntze, Rev. Gen. Pl. 1 (1891) 187. — *Abarema borneense* (Benth.) Kosterm., Bull. Organ. Natuurw. Onderz. Indon. 20 (1954) 66, f. 47, 48; Adansonia sér. 2, 6 (3) (1966) 354.

Shrub or small tree to 12 m high, 12 cm in diameter. Branchlets terete or  $\pm$  angled by ridges decurrent from the leaf-scars, scarcely puberulous by patent hairs, glabrescent. *Leaves*: rachis (3)–6–10.5(–12) cm, puberulous, gland strongly raised, circular and concave, rarely linear-oblong with a central depression, c. 2–4 mm long; pinnae 1 or 2 pairs, 2–13 cm, puberulous; petiolules 2–5 mm, puberulous; leaflets (1)–2–5 pairs per pinna, opposite, coriaceous, drying grey-green to dark brown, equal-sided to very unequal-sided, usually obliquely ovate, obovate, broadly elliptic, or subtrapezoid (–lanceolate) 5–18 by 2.5–10 cm, base broadly cuneate to rounded, apex acuminate(–caudate), upper surface subglabrous with puberulous main vein, lower surface subglabrous with a few scattered hairs on the major veins and margins only; principal lateral veins 7–14(–20) per leaflet-half, parallel, oblique, straight; reticulation prominulous or prominent on both surfaces. *Inflorescences* terminal and axillary at the distal leaves, puberulous, consisting of pedunculate umbels aggregated into panicles to c. 40 by 50 cm; umbels consisting of c. 4–7 flowers, pedicels to 4 mm; floral bracts ovate elliptic, acute, c. 0.6 mm, puberulous to sericeous. *Flowers* pentamerous, bisexual. Calyx greenish yellow, cup-shaped, 1–2 mm, appressed-puberulous or sericeous; teeth deltoid, to 0.2 mm. Corolla cream, funnel-shaped, 5–7 mm, appressed-puberulous or sericeous; lobes ovate to ovate-elliptic acute, 2–3 mm, sometimes reflexed. *Stamens* cream, to c. 20 mm, tube equalling the corolla-tube or shorter. Ovary solitary, densely puberulous. *Pod* reddish to orange both outside and within, curved into a circle before dehiscence, densely spirally contorted after dehiscence, chartaceous-coriaceous, c. 3.5 cm in diameter, valves c. 1 cm wide, slightly sinuate between the seeds, glabrous or

subglabrous, veins inconspicuous, dehiscence first along the ventral suture. *Seeds* black, ellipsoid, compressed, c. 9 by 7 by 4 mm.

Distribution – *Malesia*: Sumatra (Bengkali Is., Bila), Borneo.

Habitat & Ecology – Lowland freshwater swamp, peat-swamp forest, heath forest, a few records from low mossy forest on sandstone ridges and peaks; altitude 0–1020 m.

Field notes – Sometimes with small, narrow buttresses or stilts to 60 cm high. Bark smooth, grey or chocolate-brown, flaky, mottled with small, raised lenticels; inner bark pale red; sapwood brown to white.

Taxonomy – For notes on variation see Nielsen, l.c.

**3. *Archidendron bubalinum*** (Jack) Nielsen, Adansonia sér. 2, 19 (1) (1979) 16; Fl. Thailand 4, 2 (1985) 212; Opera Bot. 76 (1984) 50, f. 22. — *Inga bubalina* Jack, Mal. Misc. 2 (1822) 771. — *Pithecellobium bigeminum* (L.) Mart. var. *bubalinum* (Jack) Benth., Lond. J. Bot. 3 (1844) 207, p.p., excl. Wallich 5272. — *Pithecellobium bubalinum* (Jack) Benth., Trans. Linn. Soc. 30 (1875) 576; Heyne, Nutt. Pl. Ned. Ind. ed. 2 (1927) 700; Burkill, Dict. 2 (1935) 1789; Corner, Wayside Trees 1 (1940) 419; Whitm., Tree Fl. Malaya 1 (1972) 284. — *Feuilleea bubalina* (Jack) O. Kuntze, Rev. Gen. Pl. 1 (1891) 187, nom. inval. — *Cylindrodrelapha bubalina* (Jack) Kosterm., Bull. Org. Natuurw. Onderz. Indon. 20 (1954) 20, p.p., excl. syn. *Albizia bubalina* Kurz. — *Ortholobium bubalinum* (Jack) Kosterm., Commun. For. Res. Inst. 54 (1956) 7, nom. rejic. *Albizia* ? *acradena* Miq., Sumatra (1960/61) 104, 281.

*Pithecellobium ellipticum* auct. non (Bl.) Hassk.: Ridley, Fl. Mal. Pen. 1 (1922) 661, p.p., quoad Derry 577.

*Pithecellobium lobatum* auct. (non Benth.) Ridley: Ridley, Fl. Mal. Pen. 1 (1922) 661, p.p.

Small tree, rarely to 20 m high, 25 cm in diameter. Branchlets terete, red, glossy, drying reddish to light brown when dry, scaly, rusty puberulous, glabrescent. *Leaves*: petiole 0.5–4(–6) cm, glabrous(–puberulous), gland orbicular, sessile, semiglobose, flat, or depressed; pinnae 1 pair, 2–10 cm, glabrous(–puberulous); petiolule 2–5 mm, glabrous; leaflets 1 or 2 pairs per pinna, opposite, chartaceous-coriaceous, drying grey-green,  $\pm$  unequal-sided, elliptic, ovate-elliptic, or lanceolate, 5.5–16(–22) by 2.5–10.5 cm, base  $\pm$  symmet-



rically cuneate, somewhat tapering in the distal pair of leaflets, apex obtusely acuminate, glabrous at both surfaces; principal lateral veins c. 7 per leaflet-half, strongly arching, non parallel; reticulation delicate, dense, prominulous on both surfaces. *Inflorescences* terminal or axillary at the distal leaves, rusty tomentose-puberulous,  $\pm$  glabrescent, consisting of pedunculate glomerules aggregated into panicles to 20 cm long; glomerules composed of c. 5 sessile or subsessile flowers; floral bracts triangular, acute, less than 1 mm, tomentose. *Flowers* pentamerous, white, sweetly scented. Calyx campanulate or broadly cup-shaped, 1.5–2.5 mm, rusty short-tomentose or puberulous; teeth (broadly) triangular, to 0.5 mm. Corolla funnel-shaped, puberulous, 2.5–5 mm; lobes triangular-ovate to elliptic, often recurved, 1–c. 2 mm. *Stamens* c. 9 mm, the tube equalling the corolla-tube. Ovary solitary, glabrous. *Pod* green or red, becoming yellowish outside, reddish inside, cylindrical to compressed, straight or  $\pm$  curved, turgid, 3.5–10 by 1.5–2.5 cm, woody, densely puberulous or subglabrous, veins inconspicuous, dehiscing along both sutures. *Seeds* black, filling the entire cavity of the pod, the central ones irregularly disc-like, 8–15 mm high, terminal ones turbinate-truncate.

*Distribution* — S Thailand; in *Malesia*: Malay Peninsula, Sumatra.

*Habitat & Ecology* — Primary and secondary rain forest, often emerging in regrowth; soil sandy loam or lateritic; altitude 0–100(–900) m. Fl., fr. Jan.–Oct.

*Field notes* — Bark smooth to minutely fissured, fawn and grey to grey-yellowish, with scattered, large warts all over the bole; inner bark red-brown or pinkish brown. Sapwood white to pale yellow, cream inwards, fresh cut smelling of garlic, as are twigs and pods.

*Uses* — Seeds used for flavouring food; they contain large amounts of djenkol acid and need the same treatment as those of *I. A. jiringa*. Timber used for planking and said to be durable (cf. Burkill, l.c.).

**4. *Archidendron clypearia* (Jack) Nielsen**, *Adansonia* sér. 2, 19 (1) (1979) 15; Fl. Camb. Laos Vietnam 19 (1981) 115, pl. 21: 1–5; *Opera Bot.* 76 (1984) 52, f. 25, 26; Fl. Thailand 4, 2 (1985) 208, f. 52. — *Inga clypearia* Jack, *Mal. Misc.* 2, 7 (1822) 78. — *Pithecellobium clypearia* (Jack) Benth., *Lond. J. Bot.* 3 (1844) 209; Backer & Bakh. f., *Fl. Java* 1 (1963) 551; Whitm., *Tree Fl. Malaya* 1 (1972) 284; Cockb., *Trees Sabah* 1 (1976) 195. — *Feuillea*

*clypearia* (Jack) O. Kuntze, *Rev. Gen. Pl.* 1 (1891) 187, nom. inval. — *Abarema clypearia* (Jack) Kosterm., *Bull. Organ. Natuurw. Onderz. Indon.* 20 (1954) 42, p.p.; *Adansonia* sér. 2, 6 (3) (1966) 354; Verdc., *Manual New Guin. Legum.* (1979) 214.

*Mimosa heterophylla* Roxb., *Hort. Beng.* (1814) 40, nom. nud.; Fl. Ind. 2 (1832) 545, non Lam. (1783). — *Albizia heterophylla* (Roxb., non Lam.) Kurz, *Rep. Pegu, App. A* (1875) 56; J. As. Soc. Beng. 45, 2 (1876) 300. — *Feuillea heterophylla* (Roxb., non Lam.) O. Kuntze, *Rev. Gen. Pl.* 1 (1891) 185.

*Inga dimidiata* Hook. & Arnott, *Bot. Beech. Voy.* (1832) 181.

*Mimosa trapezifolia* Roxb., *Fl. Ind.* 2 (1832) 546, non Vahl (1807).

*Pithecellobium angulatum* Benth., *Lond. J. Bot.* 3 (1844) 208. — *Albizia angulata* (Benth.) Kurz, *Rep. Pegu, App. B* (1875) 47. — *Abarema angulata* (Benth.) Kosterm., *Bull. Org. Nat. Onderz. Indon.* 20 (1954) 47, f. 29, 30. — *Abarema clypearia* (Benth.) Kosterm. var. *angulata* (Jack) Kosterm., *Adansonia* sér. 2, 6 (3) (1966) 353.

*Inga kawahuruna* Voigt, *Hort. Suburb. Calc.* (1845) 358.

*Pithecellobium angulatum* Benth. var. *intermedia* Prain, *J. As. Soc. Beng.* 66, 2 (1897) 275.

*Pithecellobium clypearia* (Jack) Benth. var. *acuminatum* Gagnep., *Fl. Gén. Indo-Chine* 2 (1913) 107.

#### subsp. *clypearia*

Shrub or much-branched tree to 22 m high; bole to 14 m high, d.b.h. 10–25 cm. Branchlets strongly angled or winged by decurrent leaf-scars, puberulous or tomentose. *Leaves*: rachis up to 30 cm, puberulous, with glands sessile or stipitate, flat or urceolate, elliptic or circular; pinnae (2–)3–14 pairs, puberulous, 2–15 cm long; leaflets 4–29 pairs per pinna, subsessile, opposite, chartaceous, drying dark (rarely glaucous beneath), unequal-sided, (ovate-)trapezoid to oblong, 0.35–11.5 by 0.15–4.5 cm, base asymmetrically cuneate, apex acuminate, both surfaces subglabrous, puberulous to velutinous or tomentose; lower surface with papillose epiderm, main vein diagonal, number of principal lateral veins very variable, reticulation very lax, prominulous on both surfaces. *Inflorescences* terminal, puberulous or tomentose, consisting of pedunculate umbels or corymbs aggregated into panicles to more than 30 cm long; umbels or corymbs of c. 10 flowers, pedicel 1–4.5 mm, puberulous; floral bracts puberulous to tomentose. *Flowers* pentamerous, bisexual. Calyx light green,

cup-shaped, campanulate or funnel-shaped, 1–c. 3 mm, puberulous to sericeous; teeth triangular, acute, minute. Corolla creamy white or yellow, funnel-shaped or campanulate, 4–11 mm, puberulous or sericeous; lobes ovate or lanceolate, acute, 2–3 mm. *Stamens* creamy white or yellow, to c. 13 mm; the tube equalling the corolla-tube. Ovary solitary, puberulous or sericeous. *Pod* orange-yellowish outside, reddish inside, flattened, spirally twisted, somewhat sinuate between the seeds, chartaceous(-subcoriaceous), to 20 cm by 1 cm, puberulous or tomentose, veins inconspicuous, dehiscing along the ventral suture and partly along the dorsal suture. *Seeds* black, ovoid to ellipsoid, 6–10 by 6–9 by 6–7 mm.

Distribution – Tropical Asia: Ceylon and S India [subsp. *subcoriaceum* (Thwaites) Nielsen]; the type subspecies (with 4 varieties) in India (Sikkim), Bangladesh, Assam, Burma, S China, Thailand, Indo-China; in *Malesia*: throughout the region, except for the Lesser Sunda Islands and the Bismarck Archipelago. The most common and widespread species of the genus.

Habitat & Ecology – Primary and secondary rain forest, swamp forest, peat-swamp forest, open land; on sandy soil and clayey or grey silt; altitude 0–1850 m. Fl., fr. throughout the year.

Field notes – Bark brown with horizontal or vertical lenticles and fine vertical cracks, underbark greenish or reddish brown; sapwood white.

Uses – Leaves used for tanning and colouring of rattan.

Taxonomy – In *Malesia* 4 varieties of subsp. *clypearia* are found; subsp. *subcoriaceum* is endemic to S India and Ceylon (Nielsen 1984).

#### KEY TO THE VARIETIES

- 1a. All the leaflets of a pinna ± similar in size
  - b. var. **casai**
- b. Distal leaflets of a pinna larger than the proximal ones . . . . . 2
- 2a. Corolla 10–11 mm long
  - c. var. **sessiliflorum**
- b. Corolla 4–8.8 mm . . . . . 3
- 3a. Lower surface of leaflets woolly or velutinous
  - d. var. **velutinum**
- b. Lower surface of leaflets sericeous or subglabrous . . . . . a. var. **clypearia**

#### a. var. **clypearia**

Leaves with (2–)3–5(–7) pairs of pinnae; terminal pinnae with 4–10 pairs of leaflets; leaflets (1.5–)1.7–11.5 by (0.8–)1–4.5 cm, the distal leaf-

lets of a pinna larger than the proximal ones; lower surface of leaflets subglabrous to puberulous(-sericeous). Calyx 1–2.5 mm. Corolla 4–8.8 mm.

Distribution – India (Sikkim), Bangladesh, Assam, Burma, S China, Indo-China, Thailand; in *Malesia*: Malay Peninsula, Sumatra, Java, Borneo, Celebes, Philippines.

Habitat & Ecology – Primary and secondary rain forest, swamp forest, peat-swamp forest, open land; soil sandy, clayey or grey silt; altitude up to 1200 m. Fl., fr. throughout the year.

b. var. **casai** (Blanco) Nielsen, Opera Bot. 76 (1984) 54. — *Mimosa scutifera* Blanco var. *casai* Blanco, Fl. Filip. (1837) 736; ed. 2 (1845); ed. 3, 3 (1879) 138, t. 447.

*Inga falciformis* Hassk., Flora 25, Beibl. 2 (1842) 54, 104, non DC. (1825); Tijds. Natuurl. Ges. & Phys. 10 (1843) 149, 'fasciformis'.

*Pithecellobium montanum* Benth., Lond. J. Bot. 3 (1844) 209.

*Pithecellobium subacutum* Benth., Lond. J. Bot. 3 (1844) 210. — *Feuillea subacuta* (Benth.) O. Kuntze, Rev. Gen. Pl. 1 (1891) 189.

*Inga falcifolia* Hassk., Tweede Cat. Pl. Tuin Buitenzorg (1844) 291; Flora 30 (1847) 706. — *Pithecellobium falcifolium* (Hassk.) Hassk., Pl. Jav. Rar. (1848) 418.

*Inga subfalcata* Zoll. & Mor., Nat. Geneesk. Arch. Ned. Ind. 3 (1846) 73, 81. — *Pithecellobium montanum* Benth. var. *subfalcatum* (Zoll. & Mor.) Miq., Fl. Ind. Bat. 1 (1855) 37, nom. rejic.

*Pithecellobium montanum* Benth. var. *variegatum* Miq., Fl. Ind. Bat. 1 (1855) 37.

*Pithecellobium clypearia* (Jack) Benth. var. *densius tomentella* Miq., Fl. Ind. Bat. 1 (1855) 36, nom. rejic.

*Pithecellobium montanum* Benth. var. ? *microphylla* Benth., Trans. Linn. Soc. 30 (1875) 581, nom. rejic.

*Pithecellobium parvifolium* Merr., Bur. Govt. Lab. Philipp. 29 (1905) 19, non Benth. (1844).

*Pithecellobium prainianum* Merr., Philipp. J. Sc., Suppl. 1 (1906) 61.

*Abarema clypearia* (Jack) Kosterm. forma *montana* Kosterm., Bull. Organ. Natuurw. Onderz. Indon. 20 (1954) 45, nom. rejic.

*Abarema clypearia* (Jack) Kosterm. forma *prainiana* Kosterm., Bull. Organ. Natuurw. Onderz. Indon. 20 (1954) 46; *Adansonia* sér. 2, 6 (3) (1966) 354, nom. rejic.

*Abarema clypearia* (Jack) Kosterm. forma *subacutum* Kosterm., *Adansonia* sér. 2, 6 (3) (1966) 354, nom. rejic.

Leaves with (2–)5–14 pairs of pinnae; terminal pinnae with (8–)10–29 pairs of leaflets; leaflets 0.35–2.5 by 0.15–1.2(–1.7) cm, all those of a pinna similar in shape and size, or nearly so; lower surface of leaflets puberulous, scarcely sericeous or velutinous. Calyx 0.8–2.5(–4) mm. Corolla 3.5–8(–9.5) mm.

Distribution – *Malesia*: Malaya Peninsula, Java, Borneo, Philippines.

Habitat & Ecology – Primary and secondary lowland rain forest and peat-swamp forest, most common in montane forest; altitude 0–1850 m. Fl., fr. throughout the year.

Taxonomy – For notes on variation see Nielsen, l.c.

**c. var. *sessiliflorum*** (Merr.) Nielsen, Opera Bot. 76 (1984) 54. — *Pithecellobium sessiliflorum* Merr., Philipp. J. Sc. 17 (1920) 262; Enum. Philipp. 2 (1923) 244. — *Abarema sessiliflora* (Merr.) Kosterm., Bull. Organ. Natuurw. Onderz. Indon. 20 (1954) 41. — *Archidendron clypearia* (Jack) Nielsen subsp. *sessiliflorum* (Merr.) Nielsen, Adansonia sér. 2, 19 (1) (1979) 15.

*Pithecellobium cuneadenum* Kosterm., Reinwardtia 3 (1954) 9, f. 4; Whitm., Tree Fl. Malaya 1 (1972) 285. — *Abarema cuneadena* (Kosterm.) Kosterm., Bull. Organ. Natuurw. Onderz. Indon. 20 (1954) 35.

Differs from var. *clypearia* by: calyx c. 3 mm; corolla 10–11 mm.

Distribution – Peninsular Thailand; in *Malesia*: Malay Peninsula, Philippines (Mindanao).

Habitat & Ecology – Rain forest; altitude 0–330 m.

**d. var. *velutinum*** (Merr. & Perry) Nielsen, Opera Bot. 76 (1984) 54. — *Pithecellobium clypearia* (Jack) Benth. var. *velutinum* Merr. & Perry, J. Arnold Arbor. 23 (1942) 394. — *Abarema clypearia* (Jack) Kosterm. subsp. *velutina* (Merr. & Perry) Verdc., Kew Bull. 32 (1977) 231; Manual New Guin. Legum. (1979) 214.

Leaves with 2–7 pairs of pinnae; terminal pinnae with 5–9 pairs of leaflets; leaflets 1.6–6.5 by 0.7–3 cm, the distal leaflets of a pinna larger than the proximal ones, lower surface of leaflets woolly to velutinous. Calyx 0.5–1 mm. Corolla 4–5 mm long.

Distribution – *Malesia*: Celebes, Sula Islands, Ceram, Amboina, New Guinea.

Habitat & Ecology – Rain forest, mangrove-forest, regrowth at forest edges and roadsides; altitude 0–900 m. Fl., fr. throughout the year.

**5. *Archidendron cockburnii*** Nielsen, Opera Bot. 76 (1984) 63, f. 33, 34.

*Abarema motleyana* auct. non (Benth.) Kosterm.: Kosterm., Bull. Organ. Natuurw. Onderz. Indon. 20 (1954) 56, p.p.; Adansonia sér. 2, 6 (3) (1966) 357.

Tree to 40 m high; bole to 20 m high, girth c. 100 cm. Branchlets angular by ridges decurrent from the leaf-bases, brownish, dotted by red-brown lenticels, scarcely puberulous. *Leaves*: rachis 3–16 cm, ± puberulous, with 1–3 glands, narrow and slit-like to narrowly oblong-elliptic, with slightly raised margin and depressed central part, 2–10 mm; pinnae 1 pair, 6–14 cm, puberulous; petiolules 2–5 mm, puberulous; leaflets 2 or 3 pairs per pinna, opposite, coriaceous(–chartaceous), drying brown to green-brown, unequal-sided, elliptic-lanceolate or lanceolate, 4–15 by 2–7 cm, base asymmetrically cuneate, apex acuminate, sometimes mucronulate, upper surface glabrous except for the scarcely puberulous major veins, lower surface puberulous; principal lateral veins 6–10 per leaflet-half, non-parallel, arching; reticulation lax, raised but hardly visible above, prominent beneath. *Inflorescences* terminal, puberulous, consisting of pedunculate glomerules (or umbels) aggregated into panicles to 30 by 35 cm; glomerules consisting of c. 5 subsessile or sessile flowers, pedicel up to 1 mm; floral bracts ovate, acute, c. 1 mm, puberulous. *Flowers* pentamerous, bisexual, pale yellowish white or cream. Calyx narrowly cup-shaped, 3.5–4.8 mm, densely appressed-puberulous or sericeous; teeth deltoid, acute, 0.3–0.5 mm. Corolla funnel-shaped, 7–11.2 mm, densely appressed-puberulous or sericeous; lobes triangular-ovate or ovate-elliptic, acute, 2.5–5 mm. *Stamens* to 30 mm long, tube equalling or shorter than the corolla-tube. Ovary solitary, puberulous. *Pod* ferruginous or chocolate-brown outside, apricot-red or orange within, spirally contorted, 14–25 by 1.5–2.2 cm, coriaceous–chartaceous, valves only slightly sinuate between the seeds, shortly tomentose, veins prominulous, dehiscing along both sutures. *Seeds* black, glossy, ellipsoid, slightly compressed, 15–16 by 8–12 by 6 mm.

Distribution – *Malesia*: Borneo.

Habitat & Ecology – Primary and secondary rain forest, riverine forest; altitude 16–450 m. Fl. Feb., July, Oct.; fr. Apr., July.

Field notes – Bole sometimes ± fluted or buttressed at the base. Bark brown, grey or brown with grey patches, with transverse rows of lenticels; inner bark pale, greenish-yellow; sapwood white or pale yellow; heartwood yellowish.



**6. Archidendron contortum** (Mart.) Nielsen, *Adansonia* sér. 2, 19 (1) (1979) 16; *Opera Bot.* 76 (1984) 58, f. 27, 28; *Fl. Thailand* 4, 2 (1985) 211, f. 52. — *Inga contorta* Graham in Wall., *Cat.* (1831/32) 5283A, nom. nud. — *Pithecellobium contortum* Mart., *Flora* 20 (1837) Beibl. 115; Burkill, *Dict.* 2 (1935) 1760; Whitm., *Tree Fl. Malaya* 1 (1972) 285. — *Feuillea contorta* (Mart.) O. Kuntze, *Rev. Gen. Pl.* 1 (1891) 187. — *Abarema contorta* (Mart.) Kosterm., *Bull. Organ. Natuurw. Onderz. Indon.* 20 (1954) 31.

*Inga finlaysonianana* Graham in Wall., *Cat.* (1831/32) 5284, nom. nud.

Shrub or small tree to 10 m high, 8 cm in diameter. Branchlets terete, brownish, scarcely puberulous or velutinous. *Leaves*: rachis up to 28 cm, velutinous, glands sessile, circular to oblong, flat to concave and with raised margins, 0.5–1.5 mm; pinnae 5 pairs or more, to 15 cm long, puberulous to velutinous; leaflets 10–22 pairs per pinna, subsessile, opposite, chartaceous, drying brown or brown-green, unequal-sided,  $\pm$  trapezoid, 0.5–3.5 by 0.5–1.2 cm, base asymmetrically half truncate/half cuneate, apex broadly acute or rounded, mucronulate or rarely emarginate, upper surface puberulous, lower densely puberulous or tomentose, main vein diagonal, lateral veins hardly visible. *Inflorescence* terminal, puberulous or velutinous, consisting of shortly pedunculate glomerules, aggregated into panicles to 50 cm long; glomerules composed of 1–3 (sub)sessile flowers; floral bracts oblong, acute, c. 1 mm, puberulous. *Flowers* pentamerous, bisexual. Calyx green, cup-shaped, c. 1 mm, glabrous or puberulous; teeth deltoid, inconspicuous,  $\pm$  ciliate. Corolla greenish white to cream, campanulate, c. 2.5 mm, glabrous; lobes lanceolate, acute, c. 1.5 mm. *Stamens* creamy white or white, to 10 mm long, tube equalling the corolla-tube. Ovary solitary, subglabrous, with a few scattered hairs only. *Pod* orange outside, reddish orange within, contorted into a circle, spirally twisted after dehiscence, chartaceous, to 20 by 2 cm, slightly sinuate between the seeds, puberulous, veins inconspicuous, dehiscing first along the ventral suture. *Seeds* bluish-black, ovoid or globose,  $\pm$  flattened, c. 8 mm in diameter.

*Distribution* – Peninsular Thailand; in *Malesia*: Malay Peninsula, Sumatra, Lingga Archipelago.

*Habitat & Ecology* – Understorey of primary and secondary lowland and montane rain forest; common on ridges, also in rocky habitats; altitude 0–1100 m. Fl., fr. throughout the year.

*Field notes* – Bark smooth, grey or red-brown,

inner bark white; sapwood white. Seeds sometimes germinating while held in the dehiscent pod.

**7. Archidendron crateradenum** (Kosterm.) Nielsen, *Opera Bot.* 76 (1984) 49, f. 18. — *Pithecellobium crateradenum* Kosterm., *Reinwardtia* 3 (1954) 21, f. 18. — *Abarema crateradena* (Kosterm.) Kosterm., *Bull. Org. Natuurw. Onderz. Indon.* 20 (1954) 62, f. 8.

*Pithecellobium minahassae* auct. non Koord.: Koord., *Meded. Lands Pl. Tuin* 19 (1898) 443, 630; *Suppl. Celebes* 2 (1922) pl. 18; 3 (1922) 10, p. p., quoad *Koorders 17703* et pl. 18, f. 2.

Tree to 15 m high, 20 cm in diameter. Branchlets terete, brownish, scarcely puberulous, glabrescent. *Leaves*: petiole (3–)12.5 cm, puberulous, gland nest-shaped with the upper part of the gland bent over the cavity as a lid, c. 4 mm high, 4 mm wide; pinnae 1 pair, (3.5–)11–15 cm; petiolules 6–9 mm, puberulous; leaflets  $1\frac{1}{2}$ –3 pairs per pinna, opposite, lower leaflet sometimes unpaired, chartaceous, drying greenish with yellowish-brown veins, unequal-sided, obliquely subcordate or ovate-elliptic, 11–27 by 7–16.5 cm, base rounded, apex abruptly acuminate, both surfaces glabrous or the major veins puberulous beneath; principal lateral veins c. 9 per leaflet-half, non-parallel, arching, prominent on both surfaces. *Inflorescences* terminal, rusty tomentose, glabrescent, consisting of pedunculate glomerules aggregated into panicles 9.5–25 cm long; glomerules composed of 4 subsessile flowers; pedicels 0.5–1 mm; floral bracts ovate, acute, 0.75 mm, hairy. *Flowers* pentamerous, male or bisexual. Calyx cup-shaped, 2–3 mm, sericeous; teeth irregular, triangular-deltoid, dentate, 0.3–1 mm. Corolla funnel-shaped, 6–7.5 mm, tube glabrous in the proximal part, sericeous in the distal part; lobes elliptic, acute, 2.5–2.6 mm, sericeous. *Stamens* white, tube shorter than the corolla-tube. Ovary solitary, puberulous. Pod and seeds unknown.

*Distribution* – *Malesia*: Sula Islands and Celebes (Minahassa).

*Habitat & Ecology* – Habitat unknown; altitude up to 500 m. Fl. Jan.

**8. Archidendron ellipticum** (Blume) Nielsen, *Adansonia* sér. 2, 19 (1) (1979) 21; *Opera Bot.* 76 (1984) 68, f. 38, 39; *Fl. Thailand* 4, 2 (1985) 215, f. 53. — *Inga elliptica* Blume, *Cat.* (1823) 88. — *Pithecellobium ellipticum* (Blume) Hassk., *Retzia* 1 (1855) 225, 236; Backer & Bakh. f., *Fl. Java* 1 (1963) 552; Whitm., *Tree Fl. Malaya*

1 (1972) 286; Cockb., *Trees Sabah* 1 (1976) 196. — *Feuillea beccariana* O. Kuntze, *Rev. Gen. Pl.* 1 (1891) 184. — *Abarema elliptica* (Blume) Kosterm., *Bull. Org. Natuurw. Onderz. Indon.* 20 (1954) 53; Adansonia sér. 2, 6 (3) (1966) 355; De Vogel, *Seedlings Dicot.* (1980) 304, f. 105.

*Pithecellobium fasciculatum* Benth., *Lond. J. Bot.* 3 (1844) 208. — *Albizia fasciculata* (Benth.) Kurz, *J. As. Soc. Beng.* 45, 2 (1876) 129, p.p., excl. *Pithecellobium macrophyllum* Teijsm. & Binnend.

*Pithecellobium waitzii* Kosterm., *Reinwardtia* 3 (1954) 13, f. 6. — *Abarema waitzii* (Kosterm.) Kosterm., *Bull. Organ. Natuurw. Onderz. Indon.* 20 (1954) 52, f. 6.

Tree to 20 m high, 50 cm in diameter. Branchlets terete, glabrous. *Leaves*: rachis 4–15 cm, glabrous, glands oblong or rhomboid, hardly raised or cushion-shaped, without raised margins, 3–5 mm; pinnae (1 or) 2 pairs, c. 5–15 cm, glabrous, glands obtriangular or rhomboid, flat, sessile, without raised margins; petiolules c. 6–8 mm, glabrous; leaflets 2–4 pairs per pinna, opposite, rigidly chartaceous, drying dark green above, bright green beneath, ovate, ovate-elliptic, elliptic, or obovate-elliptic,  $\pm$  equal-sided, 3.5–20(–37) by 3–9 (–18.5) cm, base symmetrically rounded or broadly cuneate, apex shortly and obtusely acuminate, both surfaces glabrous; principal lateral veins 6–8 per leaflet-half,  $\pm$  parallel, strongly oblique, slightly arching, some of the secondary lateral veins forming trabeculate anastomoses; reticulation prominulous above, prominent beneath. *Inflorescences* terminal and axillary at the distal leaves, yellowish sericeous in the distal parts, glabrescent, consisting of pedunculate glomerules aggregated into panicles, c. 50 by 30 cm; glomerules consisting of 2–6 (sub)sessile flowers; floral bracts orbicular, obtuse 0.5–1 mm, sericeous. *Flowers* pentamerous, bisexual. Calyx yellow or yellowish-green, broadly campanulate, 1.5–2(–4) mm, scarcely sericeous; teeth triangular acute, 0.5–1 mm. Corolla yellow or yellowish-green, campanulate, 4.5–5(–9) mm, sericeous; lobes elliptic-lanceolate, acute, reflexed, 2–2.5(–4) mm. *Stamens* white, c. 6 mm, tube equalling the corolla-tube. Ovary solitary, glabrous. *Pod* yellowish or red-brown outside, reddish-orange within, curved into a circle 4.5–8 cm in diameter, valves 2–3.5 cm wide, coriaceous, not sinuate, often spirally twisted after dehiscence, glabrous, inconspicuously veined, dehiscing along both sutures. *Seeds* black with a bluish bloom, ellipsoid, c. 17–21 by 10–11(–15) mm. — **Fig. 13.**

Distribution – Nicobar Islands, Peninsular Thailand; in *Malesia*: Malay Peninsula, Sumatra, Java, Borneo, Philippines.

Habitat & Ecology – Primary and secondary rain forest, common at forest margins and along rivers and creeks; soil sandy or clayey, brown or black; altitude 0–600 m. Fl., fr. throughout the year.

Field notes – Bark smooth, yellowish, greyish or pale ochre, or white with brown horizontal ridges, sometimes scaly; sapwood pale yellow to whitish, heartwood dark yellowish. Branchlets sometimes hollow and inhabited by ants (very often by red fierce tailor-ants; pers. obs. in Sabah).

#### KEY TO THE SUBSPECIES

1a. Pinnae (1 or) 2 pairs; leaflets glabrous; base of leaflets on proximal pinnae symmetrically rounded or broadly cuneate

##### a. subsp. *ellipticum*

b. Pinnae 2 pairs; leaflets scattered ferrugineously puberulous beneath; base of leaflets on proximal pinnae cordate

##### b. subsp. *cordifoliolatum*

##### a. subsp. *ellipticum*

Tree to 20 m high, 50 cm in diameter. *Leaves*: pinnae (1 or) 2 pairs, base of leaflets on proximal pinnae symmetrically rounded to broadly cuneate; leaflets 3.5–20(–37) by 3–9(–18.5) cm, glabrous. Calyx 4.5–5 mm; teeth 0.5–1 mm. Corolla 4.5–5 mm, lobes 2–2.5 mm. Ovary solitary, puberulous. Pod curved into a circle, 4.5–8 mm in diameter, valves 2–3.5 cm wide. Seeds 17–21 by 10–11 mm. — **Fig. 13.**

Distribution – Nicobar Islands, Peninsular Thailand; in *Malesia*: Malay Peninsula, Sumatra, Java, Borneo, Philippines (Palawan, Tawitawi, Mindanao).

Habitat & Ecology – As the species.

Uses – Roots used as fish poison. Stems used for fencing (Palawan). Pounded leaves with water added and rubbed on the head acts as a lather against lice.

b. subsp. *cordifoliolatum* Nielsen, *Opera Bot.* 76 (1984) 68, f. 38, 39.

Shrub or small tree to 9 m high, 15 cm in diameter. *Leaves*: pinnae 2 pairs, base of leaflets on proximal pinnae cordate; leaflets on distal pinnae (4.5–)13–30 by (3.4–)7–13 cm, lower surface of leaflets ferrugineously puberulous. Calyx 4 mm,



Fig. 13. *Archidendron ellipticum* (Blume) Nielsen subsp. *ellipticum*. A. Flowering branch; B. nectary on pinna; C. flower with bracts. — *Archidendron ellipticum* subsp. *cordifoliolatum* Nielsen. D. Pod (A–C: Maxwell 78-46; D: Williams 2094).



teeth 0.5–0.7 mm. Corolla 9 mm, lobes c. 4 mm. Ovary not seen. Pod contorted into a circle, 6.6 cm in diameter, valves c. 2.5 cm wide. Seeds c. 20 by 15 mm. — **Fig. 13.**

Distribution — *Malesia*: Philippines (Negros, Mindanao).

Habitat & Ecology — Light woods and ravines; altitude c. 100–900 m.

**9. *Archidendron fagifolium*** (Blume ex Miq.)

Nielsen, *Opera Bot.* 76 (1984) 38. — *Pithecellobium fagifolium* Blume ex Miq., *Fl. Ind. Bat.* 1 (1855) 35; Backer & Bakh. f., *Fl. Java* 1 (1963) 551. — *Zygia fagifolia* (Blume ex Miq.) Kosterm., *Bull. Organ. Natuurw. Onderz. Indon.* 20 (1954) 24.

*Inga cauliflora* Zoll. & Mor., *Nat. Geneesk. Arch. Ned. Ind.* 3 (1846) 73, non Willd. (1806); Hassk., *Flora* 30 (1847) 706.

*Feuilleea lateriflora* O. Kuntze, *Rev. Gen. Pl.* 1 (1891) 188, nom. nud.

*Pithecellobium mindanaense* Merr., *Philipp. J. Sc., Bot.* 5 (1910) 18; *Enum. Philipp.* 2 (1923) 243. — *Abarema mindanaense* (Merr.) Kosterm., *Bull. Organ. Natuurw. Onderz. Indon.* 20 (1954) 63.

*Pithecellobium angulatum* auct. non Benth.: Miq., *Fl. Ind. Bat.* 1 (1855) 34; Hassk., *Retzia* ed. 2, 1 (1858) 267; Koord. & Valeton, *Bijdr.* 11 (1894) 310, p.p., quoad spec. *Blume s.n. 'Inga lateriflora Blume'*.

*Pithecellobium rostratum* auct. non Miq.: Koord. & Valeton, *Bijdr.* 11 (1894) 314, p.p., quoad syn. tantum.

Shrub, treelet or tree to 16 m high. Branchlets terete, grey-brown, dotted by brown lenticels, puberulous in the ultimate parts, glabrescent. *Leaves*: rachis (4.5–)6.5–19 cm, petiole 4.5–15 cm; glands on rachis and pinna circular, elliptic, linear, or slit-like; pinnae (1 or) 2 or 3 pairs, (3.5–)4–17 cm long, petiolules 2(–4) mm long, leaflets 2–5 pairs per pinna, opposite, chartaceous to subcoriaceous, drying brown, usually unequal-sided, ovate-elliptic to trapezoid or lanceolate, distal pairs sometimes spatulate, (1.9–)2.5–15 by (0.9–)1.3–6.7 cm, base cuneate, apex acuminate, main vein central or subcentral; principal lateral veins c. 4–7 per leaflet-half, arching upwards; reticulation prominulous above, prominent beneath. *Inflorescences* either clustered at the old leaf-scars or axillary at the leaves, puberulous, consisting of pedunculate glomerules aggregated into narrow panicles; panicle (3–)10–35 cm; glomerules composed of c. 3 ses-

sile or subsessile flowers; floral bract narrowly ovate-acute, c. 1 mm long, puberulous. Calyx light green, cup-shaped, (1–)1.2–1.6(–2) mm long; teeth 5, deltoid, 0.2 mm long. Corolla greenish white to white, funnel-shaped, 4.2–5.2 (–6) mm long, glabrous, lobes 5, ovate to elliptic, acute, 1.8–2.2 mm long. *Stamens* white or cream, to c. 15 mm long, tube exceeding the corolla-tube. Ovary solitary, glabrous. *Pod* light yellow outside, orange within, curved into a semi- or full circle, flattened, with slightly undulate margins, coriaceous, c. 11–20 cm long, 1.2–2(–2.5) cm wide, glabrous, slightly swollen over the seeds, with inconspicuous veins, dehiscing first along the ventral suture. *Seeds* black, glossy, ellipsoid, compressed, c. 8 by 4 mm.

Distribution — *Malesia*: 3 geographically separated varieties in Sumatra, Java, Borneo and the Philippines.

#### KEY TO THE VARIETIES

1a. Leaflets glabrous beneath

**a. var. *fagifolium***

b. Leaflets puberulous on the major veins . . . 2

2a. Pinna-glands slit-like . . . **b. var. *borneense***

b. Pinna-glands circular **c. var. *mindanaense***

#### **a. var. *fagifolium***

Shrub or treelet up to 6 m high, stems up to 8 cm in diameter but usually less. Pinnae 2 or 3 pairs, rachis glands circular to elliptic, raised, concave, 1–2.5 mm in diameter; pinna glands circular, raised, flat to concave, 0.8–1 mm in diameter; petiolules glabrous; leaflets ± glabrous beneath. Calyx glabrous or with ciliate margin. Pod c. 15–20 by 1.2–2(–2.5) cm.

Distribution — *Malesia*: Sumatra, Java.

Habitat & Ecology — An understorey shrub or treelet of primary and secondary rain forest, forest margins, on volcanic soil, limestone, clay; altitude 0–1000 m. Fl., fr. throughout the year.

**b. var. *borneense*** Nielsen, *Opera Bot.* 76 (1984) 39.

Small tree to 16 m tall, clear bole to 12 m tall. Pinnae 2 or 3 pairs, rachis and pinna glands linear to slit-like, not raised, 2–8 mm long; petiolules and major veins of leaflets puberulous beneath. Calyx glabrous to densely puberulous. Pod c. 11 by 1.5 cm.

Distribution — *Malesia*: *Borneo*.

Habitat & Ecology – Primary rain forest, swampy forest, forest on hillsides and on flat land; altitude up to 600 m. Fl., fr. May–Dec.

Field notes – Bark smooth, outer dark brown or brownish white, inner pink and fibrous, cambium brown, sapwood white.

**c. var. mindanaense** (Merr.) Nielsen, Opera Bot. 76 (1984) 39. — *Pithecellobium mindanaense* Merr., Philipp. J. Sc., Bot. 5 (1910) 18; Enum. Philipp. 2 (1923) 243. — *Abarema mindanaense* (Merr.) Kosterm., Bull. Organ. Natuurw. Onderz. Indon. 20 (1954) 63.

Shrub or small tree to 8 m high, 30 cm in diameter. Pinnae (1 or) 2 or 3 pairs; rachis and pinna glands circular, usually  $\pm$  raised, 0.1–1 mm in diameter, concave; petiolules and major veins of leaflets puberulous beneath. Calyx glabrous. Pod c. 14 by 1.3–1.4 cm.

Distribution – *Malesia*: Philippines (Mindanao, Basilan, Tawitawi, Jolo).

Habitat & Ecology – Ridges in rain forest; altitude up to 1150 m.

**10. Archidendron falcatum** Nielsen, Opera Bot. 76 (1984) 44.

*Pithecellobium scutiferum* auct. non (Blanco) Benth.: Merr., Philipp. J. Sc., Bot. 3 (1908) 228, p.p.

*Abarema scutifera* auct. non (Blanco) Benth.: Kosterm., Bull. Organ. Natuurw. Onderz. Indon. 20 (1954) 64, p.p.

Tree to 6 m high, 15 cm in diameter. Branchlets terete, glabrous. *Leaves* glabrous all over; petiole 4.5–7 cm, with 2 glands, transversely elliptic or circular, flat or cushion-shaped, sessile, not raised, 1.5–2 mm in diameter; pinnae 1 pair, 10.5–19 cm; petiolules 3–6 mm long; leaflets 2 or 3 pairs per pinna, opposite, chartaceous, drying dark green above, lighter green beneath, with chestnut veins, unequal-sided, ovate to ovate-elliptic or asymmetrically elliptic, widened acroscopically, (3.8–)6.5–19.5 by (1.8–)3.2–9.6 cm, base  $\pm$  symmetrically rounded or broadly cuneate, apex (short-)acuminate; principal lateral veins 5–7 per leaflet-half, arching, non parallel; reticulation prominent and dense on both surfaces. *Inflorescences* terminal, scarcely rusty puberulous in the distal parts, glabrescent, consisting of pedunculate glomerules aggregated into panicles to c. 30 cm long; glomerules composed of 3 or 4 sessile flowers; floral bracts broadly elliptic, obtuse, c. 1 mm long, puberulous. *Flowers* pentamerous, bisexual, white.

Calyx cup-shaped, 2.5 mm long, glabrous; teeth irregular, triangular, acute, 0.2–0.8 mm. Corolla funnel-shaped, 6 mm long, glabrous; lobes ovate-elliptic, acute, 2.3–2.4 mm. *Stamens* c. 25 mm, tube longer than the corolla-tube. Ovary solitary, glabrous. *Pod* brownish outside, reddish inside, falcate, sinuate to halfway down along the ventral suture between the seeds, woody, 7–13 cm long, 2–3.3 cm wide across the seeds, glabrous, swollen over the seeds, veins inconspicuous, dehiscing along both sutures. *Seeds* bluish-black, subglobose or broadly ellipsoid, 20–22 by 18–20 by 14–20 mm.

Distribution – *Malesia*: Philippines (Luzon, Mindoro, Ticao, Guinaras, Palawan).

Habitat & Ecology – Level land at low altitudes. Fl. June, July, Oct.; fr. Jan., May, June.

**11. Archidendron globosum** (Blume) Nielsen, Adansonia sér. 2, 19 (1) (1979) 18; Opera Bot. 76 (1984) 70, f. 40, 41. — *Inga globosa* Blume, Cat. (1823) 88. — *Pithecellobium globosum* (Blume) Kosterm., Reinwardtia 3 (1954) 11; Backer & Bakh. f., Fl. Java 1 (1963) 522; Whitm., Tree Fl. Malaya 1 (1972) 286. — *Abarema globosa* (Blume) Kosterm., Bull. Organ. Natuurw. Onderz. Indon. 20 (1954) 36, f. 24, p.p.; Adansonia sér. 2, 6 (3) (1966) 355.

*Albizia rostrata* Blume ex Miq., Fl. Ind. Bat. 1 (1855) 24. — *Pithecellobium rostratum* (Blume ex Miq.), Sumatra (1960/61) 104, 282. — *Feuillea rostrata* (Blume ex Miq.) O. Kuntze, Rev. Gen. Pl. 1 (1891) 188.

*Pithecellobium affine* Baker ex Benth., Trans. Linn. Soc. 30 (1875) 577.

*Feuillea similis* O. Kuntze, Rev. Gen. Pl. 1 (1891) 186.

*Abarema kiahii* Kosterm., Bull. Organ. Natuurw. Onderz. Indon. 20 (1954) 5.

*Abarema trichophylla* auct. non (Kosterm.) Kosterm.: Kosterm., Bull. Organ. Natuurw. Onderz. Indon. 20 (1954) 53, p.p.

Tree to 30 m high, 90 cm in diameter. Branchlets terete, red-brown, shortly rusty tomentose in the distal parts, often with glandular hairs, glabrescent. *Leaves*: rachis 6–20.5 cm, scarcely puberulous by patent hairs or shortly tomentose, glands raised, sessile, circular or semiglobose, 1.5–3 mm in diameter; pinnae 1–3 (or 4) pairs, 5–20 cm, scarcely puberulous with patent hairs or shortly tomentose; petiolules 1–4 mm, (patently) puberulous; leaflets (3 or) 4–7 pairs per pinna, opposite, chartaceous, drying dark brown/dark green above and light brown/light green beneath, usu-

ally unequal-sided, obovate, elliptic, subtrapezoid, or lanceolate-oblongate, 5–17.5 by 1.5–7 cm, base cuneate to asymmetrically half cuneate/half truncate, apex acuminate-caudate, upper surface glabrous with puberulous veins, lower surface glabrous or puberulous, often with reddish glands, midvein usually densely puberulous or hirsute; principal lateral veins 6 or 7 per leaflet-half, non parallel, strongly arching, the lower ones running into the distal half of the leaflet; reticulation dense, prominulous above, prominent beneath *Inflorescences* terminal or axillary in the distal leaf-axils, rusty tomentose and with glandular hairs, consisting of pedunculate glomerules aggregated into panicles, c. 40 by 40 cm; glomerules consisting of 25–30 sessile flowers; floral bracts spatulate, c. 1 mm, sericeous. *Flowers* pentamerous, bisexual. Calyx tubular or narrowly funnel-shaped, 3.5–5 mm, densely sericeous and with glandular hairs; teeth triangular, acute, 0.5 mm. Corolla narrowly campanulate, (6–)8–11 mm, densely sericeous and with glandular hairs; lobes triangular-ovate, acute, 2–3 mm. *Stamens* white, c. 15 mm, tube shorter than the corolla-tube. Ovary solitary, glabrous. *Pods* reddish-orange both outside and within, curved into a semi- to full circle, 6–7 cm in diameter, valves 2–3 cm wide, slightly sinuate, coriaceous, glabrous, with a few prominulous veins, dehiscing first along the ventral suture. *Seeds* bluish-black, ellipsoid,  $\pm$  compressed, c. 25 by 10–15 mm.

Distribution — Assam, Burma (Mergui Is.); in *Malesia*: Malay Peninsula, Sumatra, Java, Natuna Is., Borneo.

Habitat & Ecology — Dense lowland and hilly rain forest, lower montane forest; altitude 0–1000 m. Fl. Jan.–Apr., June, Dec.; fr. Jan., Sep.

Field notes — Bark fawn, green, or greyish, surface minutely fissured and cracked, or brown and smooth; slash inner bark cream or white with somewhat disagreeable turnip smell; sapwood white; heartwood dark yellow, soft.

Uses — The acid fruit used in curries and chutnies; the roots used for poulticing boils; wood not commercial, but used locally for beams etc. [Burkill, Dict. 2 (1935) 1759].

Taxonomy — Variable regarding the number of pinnae and leaflets, the largest number of pinnae, 2 or 3 (or 4) pairs per leaf, each with up to 7 pairs of leaflets, are found in W Java (Nielsen 1984).

**12. *Archidendron havilandii*** (Ridley) Nielsen, Opera Bot. 76 (1984) 75, f. 45, 46. — *Pithecellobium havilandii* Ridley, Kew Bull. (1933) 493; Cockb., Trees Sabah 1 (1976) 196.

— *Cylindrokelupha havilandii* (Ridley) Kosterm., Bull. Organ. Natuurw. Onderz. Indon. 20 (1954) 22, f. 17, p.p. — *Ortholobium havilandii* (Ridley) Kosterm., Comm. For. Res. Inst. 54 (1956) 7, nom. inval.

*Pithecellobium bigeminum* auct. non (L.) Mart.: Stapf, Trans. Linn. Soc. ser. 2, 4 (1894) 144.

*Pithecellobium lobatum* auct. non (Benth.) Merr.: Merr., Enum. Born. (1921) 293, p.p., quoad *Haviland* 1369.

Small shrubby or medium-sized tree, up to 40 m high; bole to 15 m high, to 75 cm in diameter. Branchlets terete to slightly angular, brownish puberulous in the distal parts, glabrescent. *Leaves*: rachis 1.5–4.5 cm, glabrous to very scarcely puberulous, gland raised, (sub)urceolate, with a narrow orifice, 2–4 mm in diameter; pinnae 1 pair, 2.5–8 cm, scarcely puberulous; petioles 2–7 mm, glabrous; leaflets  $1\frac{1}{2}$ –2 pairs per pinna, proximal pair alternate, distal pair opposite, chartaceous, drying brownish,  $\pm$  equal-sided, ovate-elliptic, elliptic, or obovate-elliptic, 5.5–22 by 3–12 cm; base symmetrically, asymmetrically cuneate, or rounded, apex obtuse, tip acuminate, upper surface glabrous, lower surface with scattered hairs, glabrescent; principal lateral veins 3–6 per leaflet-half, strongly arching, non-parallel, connected by secondary and tertiary lateral veins which form some trabeculate anastomoses, reticulation prominulous above, prominent beneath. *Inflorescences* terminal, densely rusty puberulous, consisting of pedunculate glomerules aggregated into panicles, 25 by 10–20 cm; glomerules slightly elongated, consisting of c. 5–12 sessile or subsessile flowers; floral bracts ovate or oblong, acute, c. 1.5 mm, puberulous. *Flowers* (tri- or) pentamerous, bisexual, fragrant. Calyx green, funnel-shaped, 3.1–4 mm, scarcely or densely puberulous; teeth 3–5, unequal, rounded, 1–1.3 mm. Corolla green or whitish, narrowly funnel-shaped, 6.5–8 mm, tube glabrous, lobes 5, unequal, narrowly ovate or oblong, acute, 2–3 mm, puberulous at the apex and often with papillose margins. *Stamens* white, c. 12 mm, tube shorter than the corolla-tube. Ovary solitary, glabrous. *Pod* brown outside, light brown within, straight, turgid, to 16 by 4 cm, only very slightly constricted between the seeds, woody-rigidly coriaceous, glabrous, with inconspicuous veins, dehiscing along both sutures. *Seeds* brown, bitruncate, subcylindrical, c. 12–35 mm in diameter, 10 mm high.

Distribution — *Malesia*: Borneo.

Habitat & Ecology — Primary and secondary lowland rain forest, lower montane forest, riverine



forest, regrowth; on sandstone, soils recorded as black or brown, terrain flat or sloping; altitude 0–1550 m. Fl. throughout the year.

Field notes – Bark grey, smooth or rugose with red-brown lenticels; inner bark white or dark red to brown; sapwood white; heartwood bright yellow. Fresh leaves dark green with yellowish veins.

Uses – Young fruits edible after burning (S 33389).

Taxonomy – The closest relatives of this species, formerly treated under *Cylindrokelupha* (Kostermans 1954), are found in the Indo-Chinese area (Nielsen, l.c.).

### 13. *Archidendron jiringa* (Jack) Nielsen,

*Adansonia* sér. 2, 19 (1) (1979) 32; Fl. Thailand 4, 2 (1986) 218, f. 54. — *Mimosa jiringa* Jack, Mal. Misc. 1 (1820) 14. — *Inga jiringa* Jack ex DC., Prod. 2 (1825) 439. — *Albizia jiringa* (Jack) Kurz, Prelim. For. Rep. Pegu, App. B (1875) 47; J. As. Soc. Beng. 45, 2 (1876) 300. — *Feuilleea jiringa* (Jack) O. Kuntze, Rev. Gen. Pl. 1 (1891) 184. — *Pithecellobium jiringa* (Jack) Prain, J. As. Soc. Beng. 66, 2 (1897) 267; Burkill, Dict. 2 (1935) 1761; Corner, Wayside Trees 1 (1940) 420; Backer & Bakh. f., Fl. Java 1 (1963) 552; Whitm., Tree Fl. Malaya 1 (1972) 286; Cockb., Trees Sabah 1 (1976) 195, 196. — *Zygia jiringa* (Jack) Kosterm., Bull. Organ. Natuurw. Onderz. Indon. 20 (1954) 27, f. 18, p.p. (excl. BS 44225); Kosterm., *Adansonia* sér. 2, 6 (3) (1966) 362.

*Mimosa kaeringa* Roxb., Fl. Ind. 2 (1832) 543. — *Inga kaeringa* (Roxb.) Voigt, Hort. Suburb. Calc. (1845) 258.

*Pithecellobium lobatum* Benth., Lond. J. Bot. 3 (1844) 208; Trans. Linn. Soc. 30 (1875) 575, p.p. [excl. syn. *Mimosa scutifera* Blanco, *Pithecellobium scutiferum* (Blanco) Benth., *P. lateriflorum* Blume, *P. pauciflorum* Benth.]; Ochse & Bakh., Ind. Groenten (1925) 117; ibid. English ed. (1931) 425, f. 264; Koord., Atlas 4, 7 (1926) 868, 869, f. 1156, 1157; Heyne, Nutt. Pl. Ned. Ind. ed. 2 (1927) 701.

[*Torcula* Noronha, Verh. Bat. Genoots. K. & W. 5 (1790) 66, nom. nud.]

*Inga bigemina* auct. non (L.) Willd.: Blume, Cat. (1823) 88; Hassk., Tweede Cat. (1844) 291, p.p.

*Albizia lucida* auct. non (Roxb.) Benth.: Benth. in Miq., Pl. Jungh. (1832) 267; Trans. Linn. Soc. 30 (1875) 561.

*Pithecellobium bigeminum* auct. non (L.) Mart.: Benth. in Miq., Pl. Jungh. (1852) 268, p.p., excl. syn.; Miq., Fl. Ind. Bat. 1 (1855) 32.

*Pithecellobium angulatum* auct. non Benth.: Miq., Sumatra (1860) 282, p.p., quoad *Diepenhorst* s. n.

Shrub or tree, to 21 m high, 60(–90) cm in diameter. Branchlets terete with decurrent ridges from the leaf-scars, light brown, glabrous. *Leaves*: petiole 2–7 cm, glabrous, gland(s) on petiole often present, circular in outline, sessile, subglobose to flat, 1.5–2 mm in diameter; pinnae 1 pair, to 20 cm, glabrous; petiolules 4–6 mm, glabrous; leaflets 2 or 3 pairs per pinna, opposite, drying ± dark greyish on both surfaces or green beneath, chartaceous, equal- or unequal-sided, ovate-elliptic to oblong, 5.5–20.5 by 2.4–7 cm, base ± asymmetrically rounded to broadly cuneate, apex obtusely acuminate, both surfaces glabrous; principal lateral veins c. 6–10 per leaflet-half, strongly arching, non-parallel; reticulation fine, inconspicuous or prominulous on both surfaces, more distinct beneath. *Inflorescences* either ramiflorous below the leaves or axillary at the distal leaves, with scattered hairs in the distal parts, glabrescent, consisting of glomerules aggregated into panicles to 30 cm long; glomerules or small spikes composed of 4–7 sessile flowers; floral bracts ovate or ovate-elliptic, acute, 0.5–1 mm, appressed-puberulous. *Flowers* cream or yellowish white, pentamerous, bisexual. Calyx broadly campanulate to cup-



Fig. 14. *Archidendron jiringa* (Jack) Nielsen. Seedling; a. first leaf, with one pair of leaflets per pinna only; b. second leaf; c. cotyledons (*Mathiesen* 0008, Sarawak, cult. AAU).

shaped, 1–2 mm, scarcely puberulous especially in the proximal part; teeth deltoid, acute, 0.2–0.3 mm. Corolla funnel-shaped, 4–5 mm, tube glabrous; lobes ovate-elliptic to oblong, acute, c. 2 mm, appressed-puberulous or glabrous at the apex, reflexed. *Stamens* c. 8–10 mm, tube equalling the corolla-tube. Ovary solitary, glabrous. *Pod* greyish to dark brown or dark purple outside, greyish within, falcate or twisted in a wide spiral or contorted into a circle c. 11 cm in diameter,  $\pm$  deeply lobed between the seeds along the ventral suture, at maturity most often divided quite down to the thickened dorsal suture, the segments being separated by necks, pod woody, to 20–25 by 5.2 cm, glabrous, with inconspicuous veins, dehiscing along the ventral suture. *Seeds* dark-brown, orbicular, biconvex, 2.8–3.5 cm in diameter, 1–1.5 cm thick. — **Fig. 14.**

**Distribution** — Bangladesh, Burma, Thailand; in *Malesia*: Malay Peninsula, Sumatra, Bangka, Java, Borneo.

**Habitat & Ecology** — Primary and secondary rain forest, evergreen forest; often saved when the forest is cut. Cultivated around villages. Soil sandy or clayey, lateritic; altitude 0–1000 m (up to 1627 m in Java). Fl., fr. throughout the year.

**Field notes** — Bark grey or grey-white, usually smooth, rarely  $\pm$  flaky, inner bark pink or reddish brown. Sapwood white or pinkish white, heartwood white, with a strong smell of garlic.

**Uses** — Seeds contain the toxic djenkol acid, which can be removed after two or three boilings. Used for flavouring food. Pods give a purple dye for silk; bark and leaves used for dyeing black; the leaves are used medicinally (cf. Burkill, Ochse & Bakhuizen, and Heyne, ll.cc., and Kostermans 1954: 30).

#### 14. *Archidendron kinabaluense* (Kosterm.)

Nielsen, Opera Bot. 76 (1984) 63, f. 31, 32. — *Pithecellobium kinabaluense* Kosterm., Reinwardtia 3 (1954) 15. — *Abarema kinabaluensis* (Kosterm.) Kosterm., Bull. Organ. Natuurw. Onderz. Indon. 20 (1954) 56, f. 37.

*Pithecellobium angulatum* auct. non Benth.: Heine, Feddes Rep. 54 (1951) 229, p.p.

Small or medium-sized tree, to 25 m high, bole to 8 m high, d.b.h. to 40 cm. Branchlets terete, puberulous in the distal parts, glabrescent. *Leaves*: rachis 5.5–14 cm, densely puberulous, with 2 or 3 glands, narrowly elliptic or linear (slit-like), flat or concave, margins only slightly raised, 3–11 mm; pinnae (1 or) 2 pairs, 2.5–13 cm, densely puberulous; petiolules 2–3 mm, puberulous; leaflets

(1–)2–5 pairs per pinna, opposite, rigidly chartaceous, drying dark brown, unequal-sided, ovate, elliptic-lanceolate or lanceolate, 3–15 by 1.2–4 cm, base rounded or usually asymmetrically cuneate, apex acuminate to subcaudate, upper surface glabrous except for the main vein, lower surface puberulous; principal lateral veins 9–15 per leaflet-half, parallel, straight or  $\pm$  arching; reticulation prominulous above, prominent beneath. *Inflorescences* terminal and axillary at the distal leaves densely puberulous, consisting of pedunculate umbels, aggregated into panicles of 40 by 40 cm; umbels consisting of 3–5 pedicellate flowers, pedicels 1.5–3 mm; floral bracts narrowly ovate, acute, 0.5 mm, sericeous. *Flowers* pentamerous, bisexual. Calyx cupuliform, 2–2.2(–3.5) mm, densely puberulous; teeth deltoid, 0.2–0.3 mm. Corolla pale green, funnel-shaped, (6–)6.5–7(–10) mm, densely puberulous; lobes ovate-elliptic, acute, 2.5–3.5 mm. *Stamens* white, tube equalling or shorter than the corolla-tube. Ovary solitary, densely puberulous. Pod and seeds unknown.

**Distribution** — *Malesia*: Borneo, Sarawak (G. Mulu), Sabah (G. Kinabalu).

**Habitat & Ecology** — Primary and secondary lower montane forest, on slopes and ridges, on black soil; altitude 1000–1450 m.

#### 15. *Archidendron kunstleri* (Prain) Nielsen,

Adansonia sér. 2, 19 (1) (1979) 17 ('*kuenstleri*'); Opera Bot. 76 (1984) 62, f. 31, 32. — *Pithecellobium kunstleri* Prain in King, J. As. Soc. Beng. 66, 2 (1897) 271, 517; Heyne, Nutt. Pl. Ned. Ind. ed. 2 (1927) 701; Burkill, Dict. 2 (1935) 1762; Corner, Wayside Trees 1 (1940) 421; Whitm., Tree Fl. Malaya 1 (1972) 287. — *Abarema kunstleri* (Prain) Kosterm., Bull. Organ. Natuurw. Onderz. Indon. 20 (1954) 57; Adansonia sér. 2, 6 (3) (1966) 356, p.p.

*Pithecellobium elmeri* Ridley, Kew Bull. (1933) 493, p.p.

#### KEY TO THE SUBSPECIES

- 1a. Leaflets ovate to ovate-elliptic, the lower basiscopic principal lateral vein reaching the middle of the leaflet in most leaflets. Pod puberulous, abruptly narrowed in a stout stalk c. 2.5 mm in diameter . . . . . **a. subsp. kunstleri**
- b. Leaflets ovate-elliptic to lanceolate, the lower basiscopic principal lateral vein not reaching the middle of the leaflet. Pod glabrous, gradually tapering into a slender stalk, 1–1.5 mm in diameter . . . . . **b. subsp. ashtonii**

**a. subsp. kunstleri**

Shrub or tree 2–15(–21) m high, d.b.h. 6–88 (–150) cm. Branchlets terete, scarcely puberulous, glabrescent. *Leaves*: rachis to 8 cm, scarcely puberulous, with 1 or 2 glands, oblong or elliptic, flat, sessile, margins  $\pm$  raised, 2.5–6 mm, pinnae 1 (or 2) pairs, (1–)3.3–13.5 cm, densely puberulous; petiolules c. 3 mm, puberulous; leaflets (1–)2–3 pairs per pinna, opposite, chartaceous, drying dark brown above and light brown beneath, unequal-sided, ovate or ovate-elliptic, 3.5–13 by 1.5–4.5 cm, base rounded or symmetrically cuneate, apex obtusely acuminate, upper surface glabrous except for the main vein, lower surface puberulous or glabrous; principal lateral veins 6–11 per leaflet-half, arching, non-parallel, the lower vein on the basiscopic side often reaching to about the middle of the leaflet; reticulation prominulous on both surfaces. *Inflorescences* terminal, puberulous, consisting of pedunculate glomerules aggregated into panicles of 30 by 40 cm; glomerules consisting of 3–8 sessile flowers; floral bracts ovate-elliptic, acute, c. 1 mm, sericeous. *Flowers* pentamerous, bisexual, creamish white all over. Calyx tubular or tubular-campanulate, 5–8.5 mm, sericeous, sometimes unequally divided; teeth triangular, acute, 0.5–1 mm high. Corolla narrowly funnel-shaped, 13–20 mm, sericeous; lobes ovate or broadly triangular, (2–)3–6 mm. *Stamens* c. 40–45 mm, tube shorter than corolla-tube. Ovary solitary, sericeous. *Pod* reddish outside, orange-reddish within, spirally contorted, up to 20 by 1.5 cm, or forming a circle c. 5 cm in diam., coriaceous, only slightly sinuate between the seeds, puberulous, abruptly narrowed into a stout stalk, c. 2.5 mm in diameter, veins inconspicuous, dehiscing first along the ventral suture. *Seeds* bluish-black, ovoid-subglobose, c. 12–15 by 8 mm.

*Distribution* – *Malesia*: Malay Peninsula (Johore, Pahang, Perak).

*Habitat & Ecology* – Rain forest, swamp forest, along rivers; soil clayey or sandy; altitude 0–20 m. Fl. May, July, Sep.–Dec., fr. Jan.

*Field notes* – Bark smooth, lenticellate, pink, fawn or grey.

*Uses* – Leaves used as soap.

**b. subsp. ashtonii** Nielsen, Opera Bot. 76 (1984) 62, f. 31, 32.

Differing from subsp. *kunstleri* as follows: leaflets ovate-elliptic or lanceolate, the lower basiscopic principal lateral vein not reaching the middle of the leaflet. Pod gradually narrowing into a slender stalk, c. 1–1.5 mm in diameter, glabrous.

*Distribution* – *Malesia*: Sumatra, Borneo.

*Habitat & Ecology* – Rain forest, in coastal forest frequent at the limits of the tidal influence; altitude 0–20 m. Fl., fr. throughout the year.

**16. Archidendron merrillii** (Macbr.) Nielsen, Opera Bot. 76 (1984) 48, f. 18. — *Pithecellobium merrillii* Macbr., Pub. Field Mus. Nat. Hist. Bot. 11 (1931) 26.

*Pithecellobium multiflorum* Merr., Philipp. J. Sc., Bot. 10 (1915) 11; Enum. Philipp. 2 (1923) 243, non Benth. (1875). — *Abarema multiflora* (Merr. non Benth.) Kosterm., Bull. Organ. Natuurw. Onderz. Indon. 20 (1954) 62; Adansonia sér. 2, 6 (3) (1966) 358, comb. inval.

*Pithecellobium ellipticum* auct. non (Blume) Hassk.: Merr., Enum. Philipp. 2 (1923) 243, p.p., quoad BS 31142.

Tree 3–4 m tall, d.b.h. 10 cm. Branchlets terete, dark brown, lenticellate, short-puberulous in the ultimate parts, glabrescent. *Leaves*: rachis 4–13 cm, puberulous, petiole 2.7–6.5 cm, with a gland, nest-shaped with the orifice pointing acropically, 2–5 mm long, 2.5 mm high; pinnae 1 or 2 pairs, 2–20 cm, puberulous; petiolules 4–7 mm, puberulous by semipatent hairs; leaflets (1–)2–4 pairs per pinna, opposite (or subopposite), chartaceous, drying dark red-brown above, olive-green beneath,  $\pm$  unequal-sided, (ob)ovate-elliptic to elliptic-lanceolate, 5.3–15(–22.5) by 1.4–6.4(–10) cm, base half rounded/half cuneate or broadly cuneate, apex acuminate or subcaudate with  $\pm$  blunt tip, upper surface glabrous, lower surface with puberulous major veins; principal lateral veins 6–11 per leaflet-half, upwards arching; reticulation prominent on both surfaces. *Inflorescences* terminal and axillary in the upper leaf-axils, densely puberulous to sericeous especially in the distal parts, consisting of pedunculate glomerules aggregated into panicles 16–37 cm long; glomerules composed of 4 (sub)sessile flowers; floral bract ovate, acute, 1 mm long, sericeous. *Flowers* pentamerous, bisexual. Calyx cup-shaped or campanulate, 3–5 mm, sericeous to tomentose; teeth  $\pm$  irregular, deltoid, 0.2–0.5(–2) mm. Corolla funnel-shaped, 7.5–12.5 mm, sericeous or hirsute; lobes ovate-elliptic to oblong, acute, 3–4 mm. *Stamens* 15–20 mm, the tube shorter than the corolla-tube. Ovary solitary, sericeous, sometimes with two free styles. *Pod* brownish outside, reddish within, straight or curved into a circle, flattened, only slightly sinuate and thickened over the seeds, woody, 12–19 cm long, 2.6–4.5 cm wide, glabrous, with in



conspicuous veins, dehiscing along the dorsal suture. *Seeds* black, ellipsoid, flattened, c. 23 by 16 mm.

Distribution – *Malesia*: Philippines (Luzon, Panay, Mindoro), ?Sabah.

Habitat & Ecology – Forest; 800–1300 m altitude.

Note – It is not certain whether the Sabah-specimen cited by Kostermans (1954) under the present species really belongs here (cf. Nielsen, l.c.: 49).

#### 17. *Archidendron microcarpum* (Benth.)

Nielsen, *Adansonia* sér. 2, 19 (1) (1979) 17; *Opera Bot.* 76 (1984) 51, f. 23, 24. — *Pithecellobium microcarpum* Benth., *Trans. Linn. Soc.* 30 (1875) 576; Burkill, *Dict.* 2 (1935) 1762; Whitm., *Tree Fl. Malaya* 1 (1972) 287; Cockb., *Trees Sabah* 1 (1976) 196. — *Feuillea microcarpa* (Benth.) O. Kuntze, *Rev. Gen. Pl.* 1 (1891) 188, nom. inval. — *Abarema microcarpa* (Benth.) Kosterm., *Bull. Organ. Natuurw. Onderz. Indon.* 20 (1954) 67, f. 49.

*Inga bubalina* auct. non (Jack) Wall.: Wall., *Cat.* (1831/32) 5272. — *Pithecellobium bigeminum* (L.) Mart. var. *bubalina* auct. non (Jack) Benth.: Benth., *Lond. J. Bot.* 3 (1844) 207; Miq., *Fl. Ind. Bat.* 1 (1855) 33, p.p., quoad *Wallich* 5272; Sumatra (1861) 281. — *Pithecellobium bubalinum* auct. non (Jack) Benth.: Benth., *Trans. Linn. Soc.* 30 (1875) 576, p.p., quoad *Wallich* 5272.

*Pithecellobium oppositum* auct. non (Miq.) Miq.: Miq., Sumatra (1860/61) 105, 283, p.p., quoad *Teijsmann HB* 4406.

*Pithecellobium motleyanum* auct. (non Benth.) Merr.: Merr., *Philipp. J. Sc.* 29 (1926) 372, p.p., quoad *Castro & Melegrito* 1376.

*Pithecellobium elmeri* Ridley, *Kew Bull.* (1933) 493, p.p., quoad *Elmer* 20290.

Small, straight-boled tree to 15 m high, bole up to 10.5 m high, 20 cm in diameter. Branchlets terete, densely puberulous or shortly tomentose, brownish when young, later on reddish and scaly. *Leaves*: rachis 1–17 cm, tomentose, glands circular, often with raised central part, sessile or subsessile, 1–2 mm in diameter; pinnae 1–3 pairs, to 15 cm, puberulous or tomentose; petioles to 5 mm, puberulous or tomentose; leaflets 1–4 pairs per pinna, opposite, chartaceous, drying brownish, usually somewhat unequal-sided, ovate elliptic, obovate-elliptic, or lanceolate, (2.5–)5–15 by (1–)3–7 cm, base symmetrically or asymmetrically broadly cuneate, or rounded, apex acu-

minate with obtuse tip; both surfaces glabrous but major veins occasionally scarcely puberulous; principal lateral veins 6–9 per leaflet-half, arching, non-parallel; reticulation prominulous above, prominent beneath. *Inflorescences* terminal, densely puberulous or tomentose, consisting of pedunculate glomerules aggregated into panicles to 30 (–40) by 60 cm; glomerules composed of c. 3 shortly pedicellate flowers, pedicel 0.3–0.8 mm; floral bracts oblong, acute, c. 1 mm, densely puberulous. *Flowers* pentamerous, bisexual. Calyx green, shallowly cup-shaped or subrotate, c. 0.5 mm, sericeous; teeth hardly visible, deltoid, acute. Corolla white, yellowish-green or pale green, campanulate, 2.5–3 mm, finely sericeous especially in the distal part, lobes ovate-elliptic, acute, reflexed, 1–1.5 mm. *Stamens* white or yellowish green, c. 8–11 mm, the tube equalling the corolla-tube. Ovary solitary, scarcely sericeous. *Pods*: two kinds of pods usually present; sterile ones in the outer part of the infructescence, reddish to bright orange, densely contorted, puberulous or glabrous, c. 0.5 cm wide; fertile pods in the central part of the infructescence, reddish to bright orange outside, reddish orange within, contorted into a circle 2–3 cm in diameter, valves 0.5–1.5 cm wide, coriaceous, ± sinuate between the seeds, puberulous or glabrous, veins inconspicuous, dehiscing first along the ventral suture. *Seeds* black with a bluish bloom, ellipsoid, c. 7–8 by 6 mm.

Distribution – *Malesia*: Malay Peninsula, Sumatra (incl. Bangka), Borneo.

Habitat & Ecology – Light primary and secondary rain forest, forest margins, along rivers, common on hillsides and ridge-tops, also in swampy forest; soil: sandy, sandy loam, lateritic, black, or ultrabasic; altitude 0–500 (–1200 m). Fl., fr. all year round.

Field notes – Occasionally with buttresses to 0.6 m high. Bark smooth, not fissured, but occasionally slightly cracked, grey, grey-green or grey-brown; inner bark and cambium dark red or brown-red exuding a whitish yellow latex after slashing, sapwood white or yellowish white, sometimes streaked with red.

Uses – Wood soft, white, only used locally for building purposes. The strong-smelling pods are reported to be used for seasoning of food in Malaya. Shoots and roots are prescribed against itch. The pounded leaves are used for rubbing the skin of patients suffering from smallpox (cf. Burkill, l.c.).

Taxonomy – For notes on variation see Nielsen (1984).

**18. Archidendron minahassae** (Koord.) Nielsen, Opera Bot. 76 (1984) 50, f. 18, 20. — *Pithecellobium minahassae* Teijsm. & Binnend. ex Koord., Meded. Lands Pl. Tuin 19 (1898) 443, 630; Suppl. Celebes 2 (1922) pl. 18, p.p., excl. f. 2; ibid. 3 (1922) 10, p.p., excl. *Koorders 17703*; Heyne, Nutt. Pl. Ned. Ind. (1916) 702.

*Pithecellobium macrophyllum* Teijsm. & Binnend. ex Kurz, J. As. Soc. Beng. 44, 2 (1875) 129, non Benth. (1875). — *Pithecellobium teijsmannii* Prain, J. As. Soc. Beng. 66, 2 (1897) 271, 517, nom. nud. — *Abarema teijsmannii* (Prain) Kosterm., Bull. Organ. Natuurw. Ond. Indon. 20 (1954) 64, f. 9a, 46, comb. inval.

Tree of unknown stature. Branchlets terete to ± angular in the distal parts, greyish yellow, glabrous, with light lenticels. *Leaves*: petiole 3–9 cm, glabrescent, gland slit-like, without raised margins, leading into the hollow petiole, 0.7–1.2 cm; pinnae 1 pair, (3–)9–18 cm, glabrous; petiolules 5–10 mm, glabrous; leaflets 2 pairs per pinna, opposite, lower pair subopposite, chartaceous, drying greenish with yellowish veins, unequal-sided, broadly ovate-elliptic, 16–32 by 7–17 cm, base rounded, apex bluntly acuminate; both surfaces glabrous; principal lateral veins 5–7 per leaflet-half, arching, non parallel; reticulation prominent above, prominent beneath. *Inflorescence* and *flowers* unknown. *Pod* brownish outside, orange-red inside, ?straight, strongly lobed along the ventral suture, the lobes indented to the dorsal suture, the segments separated by necks; pod coriaceous-woody, c. 15 cm long, 3.2–4 cm wide over the seeds, glabrous, veins inconspicuous. *Seeds* bluish-black, ellipsoid, c. 23 by 18 by 18 mm.

Distribution – *Malesia*: Celebes (Minahassa).

Habitat & Ecology – Rain forest; altitude 50–500 m. Fr. Jan.

**19. Archidendron oppositum** (Miq.) Nielsen, Opera Bot. 76 (1984) 60, f. 29, 32. — *Pithecellobium oppositum* Miq., Sumatra (1861) 283. — *Abarema opposita* (Miq.) Kosterm., Bull. Organ. Natuurw. Onderz. Indon. 20 (1954) 65; Adansonia sér. 2, 6 (3) (1966) 358.

*Albizia macrothyrsa* Miq., Sumatra (1861) 281. *Pithecellobium motleyanum* Benth., Trans. Linn. Soc. 30 (1875) 575; Merr., Enum. Born. (1921) 293. — *Feuillea motleyana* (Benth.) O. Kuntze, Rev. Gen. Pl. 1 (1891) 188. — *Abarema motleyana* (Benth.) Kosterm., Bull. Organ. Natuurw. Onderz. Indon. 20 (1954) 56, f. 36, p.p., quoad typ.; Adansonia sér. 2, 6 (3) (1966) 357, p.p.

Shrub or small tree, 2–3 m high. Branchlets terete, ridged by ridges decurrent from the leaf-scars, densely puberulous, glabrescent. *Leaves*: rachis 1.5–3.5 cm, puberulous, gland(s) sessile, slit-like, margins slightly raised, c. 3–11 mm long; pinnae 1 (or 2) pairs, puberulous; petiolules 2–4 mm, puberulous; leaflets 2 or 3 pairs per pinna, (proximal pinnae, when present, with 1 pair), opposite, rigidly chartaceous or coriaceous, drying glossy dark brown above and golden brown beneath, equal- or unequal-sided, ovate, elliptic, obovate-elliptic, or lanceolate, 3–9.5 by 1.7–4.5 cm, base asymmetrically half rounded/half cuneate or symmetrically cuneate, apex acuminate, often mucronulate, upper surface glabrous except for the main vein, lower surface densely appressed-puberulous (or subglabrous); principal lateral veins up to 10 per leaflet-half, parallel, oblique, straight; reticulation prominulous on both surfaces. *Inflorescences* terminal and axillary in the distal leaf-axils, puberulous, consisting of pedunculate glomerules aggregated into panicles to 33 cm long and wide; glomerules consisting of 2–5 sessile or subsessile flowers; floral bracts ovate, obtuse, c. 0.5 mm, puberulous-sericeous. *Flowers* pentamerous, bisexual, white. Calyx broadly cup- or bowl-shaped, 1–1.5 mm, puberulous or sericeous; teeth inconspicuous, c. 0.2 mm. Corolla funnel-shaped, 3.5–5.1(–5.5) mm, appressed-puberulous or sericeous, lobes triangular-ovate, acute, 1.5–1.75(–2) mm. *Stamens* c. 10 mm, the tube shorter than the corolla-tube. Ovary solitary, puberulous-sericeous. *Pod* reddish outside, reddish-orange within, contorted into a circle, only slightly sinuate between the seeds, coriaceous, c. 4–4.5 cm in diameter, valves 1.1–1.5 cm wide, puberulous, veins inconspicuous, dehiscing along both sutures. *Seeds* black, suborbicular, flattened, c. 6–7 by 5 by 3–4 mm.

Distribution – *Malesia*: Sumatra (Toba), Borneo, Lingga Archipelago.

Habitat & Ecology – Rain forest, also close to the coast; generally at low altitude. Fl. June, Aug., fr. Oct.

**20. Archidendron pahangense** (Kosterm.) Nielsen, Adansonia sér. 2, 19 (1) (1979) 22; Opera Bot. 76 (1984) 73, f. 43, 44. — *Pithecellobium pahangense* Kosterm., Reinwardtia 3 (1954) 16; Whitm., Tree Fl. Malaya 1 (1972) 287. — *Abarema pahangensis* (Kosterm.) Kosterm., Bull. Org. Natuurw. Ond. Indon. 20 (1954) 57.

Tree up to 25 m high, girth to 2 m. Branchlets terete, puberulous in the distal parts, glabrescent. *Leaves*: rachis 1–11.5 cm, scarcely puberulous or

glabrous, glands circular to elliptic,  $\pm$  sunken with strongly raised margin, 1–5 mm; pinnae 1 or 2 pairs, 3–14(–17) cm, scarcely puberulous or glabrous; petiolules c. 5 mm, puberulous or glabrous; leaflets (2 or) 3 (or 4) pairs per pinna, opposite, chartaceous, drying dark green above, light green beneath, with yellowish veins (juvenile foliage rusty red),  $\pm$  equal-sided, ovate-elliptic, elliptic, or lanceolate, 2–12(–15.5) by 0.7–6.5, base  $\pm$  symmetrically narrowly cuneate to rounded, apex obtuse with acuminate tip to subcaudate, young leaflets with  $\pm$  dense cover of reddish glands beneath, when old with scattered glands near the main vein only, upper surface glabrous; principal lateral veins 6 or 6 per leaflet-half, oblique or slightly arching, non-parallel; reticulation dense and raised on both surfaces. *Inflorescences* terminal and axillary at the distal leaves densely puberulous, consisting of pedunculate glomerules aggregated into panicles, 8–10 by 4–6 cm; glomerules consisting of 10–15 sessile flowers; floral bracts narrowly lanceolate, acute, c. 1 mm, sericeous. *Flowers* pentamerous, bisexual. Calyx campanulate, 2–2.2 mm, densely puberulous or sericeous, teeth triangular or deltoid, acute, 0.3–0.5 mm. Corolla narrowly campanulate, 5–5.5 mm, densely puberulous or sericeous; lobes lanceolate, acute, 3 mm. Staminal tube equaling the corolla-tube. Ovary solitary, glabrous. *Pod* brownish and rugulose outside, reddish inside, curved into a circle, 5.5 cm in diameter, valves 2–2.3 cm wide, scarcely or strongly sinuate, coriaceous-woody, glabrous, with inconspicuous veins, dehiscing first along the ventral suture, contorted after dehiscence. *Seeds* black, probably ovoid and strongly flattened, c. 17 by 11 by 4 mm (not seen fully mature).

Distribution — *Malesia*: Malay Peninsula (Genting Highlands).

Habitat & Ecology — Lower montane and montane forest on sandstone, locally dominating in associations with *Dacrydium*, *Fagaceae*, and *Lauraceae*; altitude 600–1500 m. Fl., fr. Aug.

Field notes — Bark smooth or cracking, grey, fawn to dull brown; inner bark red to deeply pink with a very light yellow exudate; wood white to cream. Germination hypogeal.

**21. *Archidendron palauense*** (Kaneh.) Nielsen, *Opera Bot.* 76 (1984) 43. — *Pithecellobium palauense* Kaneh., *Bot. Mag. Tokyo* 48 (1934) 733; Merr. & Perry, *J. Arnold Arbor.* 23 (1942) 293.

*Acacia laxiflora* DC., *Prod.* 2 (1825) 455; Decne., *Herb. Timor.* (1835) 132; Zoll. & Mor., *Nat. Geneesk. Arch. Ned. Ind.* 3 (1846) 72. — *Pithe-*

*cellobium laxiflorum* (DC.) Benth., *Lond. J. Bot.* 3 (1844) 312. — *Feuillea laxiflora* (DC.) O. Kuntze, *Rev. Gen. Pl.* 1 (1891) 188. — *Abarema laxiflora* (DC.) Kosterm., *Bull. Org. Natuurw. Onderz. Indon.* 20 (1954) 59, f. 39, 40; *Adansonia sér.* 2, 6 (3) (1966) 356; Verdc., *Manual New Guin. Legum.* (1979) 216.

*Pithecellobium papuanum* Scheffer, *Ann. Jard. Bot. Buitenzorg* 1 (1876) 22. — *Albizia papuana* (Scheffer) F. Muell., *Descr. Not.* 1 (1876) 24.

*Pithecellobium palauense* Hosokawa, *Trans. Nat. Hist. Soc. Form.* 34 (Nov. 1934) 414, non Kaneh. (Oct. 1934).

Unbuttressed tree to 26 m high; bole often crooked, up to 12 m high, 40 cm in diameter. Branchlets terete, greyish to brownish with pale lenticels, glabrous or very scarcely puberulous. *Leaves*: petiole 1.1–8.5 cm, glabrous; usually with 2 glands, circular or elliptic, usually raised, flat or slightly depressed in the central part, 0.5–2(–3) mm in diameter; pinnae 1 pair, 2.8–13.3 cm, glabrous or scarcely puberulous; petiolules 2–5 mm, glabrous; leaflets (1–)2–4 pairs per pinna, opposite (proximal pair sometimes subopposite), chartaceous, drying glossy bright green with straw veins,  $\pm$  unequal-sided, ovate or obovate-elliptic, oblanceolate, or lanceolate, (4–)5–17.5 by (1.8–)2.3–8.5 cm, base  $\pm$  cuneate or subattenuate, often asymmetric, apex obtusely acuminate; principal lateral veins 5–9 per leaflet-half, parallel,  $\pm$  straight; reticulation prominent and dense, both surfaces glabrous. *Inflorescences* terminal or axillary at the distal leaves, glabrous or with a few scattered hairs only, consisting of pedunculate glomerules aggregated into panicles to 40 by 50 cm; glomerules composed of 4 or 5 sessile or subsessile flowers; floral bract elliptic-oblong, acute, 0.5–1 mm long, glabrous. *Flowers* pentamerous, bisexual. Calyx greenish white, membranous, cup-shaped or campanulate, 1.5–2.5 mm long, glabrous,  $\pm$  deeply 2-lobed, teeth irregular, triangular, acute or apiculate, 0.2–0.5 mm. Corolla greenish white, membranous, funnel-shaped, (4–)5–5.5 mm long, glabrous, lobes 4 (or 5),  $\pm$  narrowly elliptic to lanceolate, acute, reflexed, c. 2–2.5 mm. *Stamens* white, 8 mm long, tube exceeding the corolla-tube. Ovary solitary, glabrous. *Pod* orange or red outside, becoming brown when old, reddish inside, loosely twisted, sinuate between the seeds, rigidly chartaceous-coriaceous, c. 15–20 by 1.8–2.4 cm, glabrous, swollen over the seeds, veins inconspicuous, dehiscing first along the ventral suture. *Seeds* purplish black, ellipsoid, up to 16 by 12 by 10 mm, slightly flattened.



Distribution – *Malesia*: Lesser Sunda Islands (Timor), Moluccas, Sula Islands, W Irian, New Britain; Solomon Islands & Carolines.

Habitat & Ecology – Primary and secondary rain forest, beach forest, on coral-limestone outcrops, seasonally inundated forest on sandy soil; recorded for clay and loam soil; altitude 0–210 m.

Field notes – Bark greyish brown with pustular lenticels in fine longitudinal and horizontal rows, with many fine, longitudinal fissures.

Note – *De Vogel 3860* (L) from Bacan Is., N Moluccas has a strongly puberulous inflorescence.

**22. *Archidendron pauciflorum*** (Benth.) Nielsen, *Opera Bot.* 76 (1984) 41. — *Pithecellobium pauciflorum* Benth., *Lond. J. Bot.* 3 (1844) 212. — *Abarema pauciflora* Kosterm., *Bull. Organ. Natuurw. Onderz. Indon.* 20 (1954) 60, f. 43; *Adansonia sér.* 2, 6 (3) (1966) 358.

*Pithecellobium caulostachyum* Merr., *Philipp. J. Sc., Bot.* 10 (1915) 10; *Enum. Philipp.* 2 (1923) 242. — *Zygia caulostachya* (Merr.) Kosterm., *Bull. Org. Natuurw. Onderz. Indon.* 20 (1954) 26.

*Pithecellobium celebicum* Kosterm., *Reinwardtia* 3 (1954) 20. — *Abarema celebica* (Kosterm.) Kosterm., *Bull. Organ. Natuurw. Onderz. Indon.* 20 (1954) 60, f. 41.

*Pithecellobium malinoense* Kosterm., *Reinwardtia* 3 (1954) 21. — *Abarema malinoensis* (Kosterm.) Kosterm., *Bull. Organ. Natuurw. Onderz. Indon.* 20 (1954) 60, f. 42.

*Pithecellobium lobatum* auct. non Benth.: Benth., *Trans. Linn. Soc.* 30 (1875) 575, p.p., quoad syn. *P. pauciflorum* Benth.

Tree to 20 m high, up to 22 cm in diameter. Branchlets terete or slightly angular in the ultimate parts, greyish, scarcely puberulous, glabrescent, or glabrous. *Leaves*: rachis (or petiole) 0.5–3.5(–7) cm, usually with 2 glands, broadly elliptic to circular, raised, flat, 1–3 mm in diameter; pinnae 1 (or 2) pairs, 3–10(–13.3) cm, with circular glands, ± raised, flat, 0.5–1 mm in diameter; petiolules c. 3 mm, glabrous; leaflets 2–4 pairs per pinna, opposite or the proximal pair subopposite, chartaceous, base ± asymmetrically cuneate or rounded, apex acuminate to subcaudate, both surfaces glabrous, reticulation prominulous above, prominent beneath. *Inflorescences* either clustered at the old leaf-scars or terminal, scarcely puberulous or glabrous, consisting of pedunculate glomerules aggregated into panicles; glomerules, composed of (1–)2–4 subsessile flowers; floral bract ovate-elliptic, acute, c. 0.5 mm long. Calyx cup-shaped, 1.2–2.2 mm long, glabrous; teeth deltoid, 0.1–

0.3 mm long. Corolla funnel-shaped, 4–5.5 mm long, glabrous; lobes ovate, acute, c. 1.2–3 mm long, sometimes reflexed. *Stamens* white, to c. 12 mm long, tube exceeding the corolla-tube. Ovary solitary, glabrous. *Pod* dark reddish or yellowish outside, reddish within, curved into a circle or spirally contorted, sinuate to submoniliform along ventral suture, chartaceous-coriaceous, up to c. 10 cm long, 0.7–1.5 cm wide over the seeds, down to 0.3 cm wide in between, glabrous, veins inconspicuous, dehiscing first along the ventral suture.

Distribution – *Malesia*: Philippines, Celebes, Flores.

#### a. var. *pauciflorum*

Branchlets terete, glabrous, usually without protruding warty short-shoots. Petiole 0.5–3.5(–7) cm, terete, not acuminate, glabrous; pinnae and petiolules glabrous; leaflets drying grey-green, with brown veins, 2.5–16.5 by (0.9–)2.5–7 cm; principal lateral veins c. 6–9 per leaflet-half, ± parallel in narrow leaflets and only slightly arching, in wide ones often strongly arching. *Inflorescences* either clustered at the old leaf-scars or terminal; panicles (2.5–)9–c. 20 cm long. *Pod* c. 10 cm long, 0.7–1.5 cm wide across the seeds. Seeds c. 8–9 by 6–8 by 4 mm.

Distribution – *Malesia*: Philippines, Celebes, Lesser Sunda Islands (Flores).

Habitat & Ecology – Rain forest; altitude 0–1200 m.

Taxonomy – Closely related to *A. palauense* (cf. Nielsen 1984).

**b. var. *caulostachyum*** (Merr.) Nielsen, *Opera Bot.* 76 (1984) 43. — *Pithecellobium caulostachyum* Merr., *Philipp. J. Sc., Bot.* 10 (1915) 10; *Enum. Philipp.* 2 (1923) 242. — *Zygia caulostachya* (Merr.) Kosterm., *Bull. Organ. Natuurw. Onderz. Indon.* 20 (1954) 26.

Ultimate parts of branchlets ± angled, scarcely puberulous, glabrescent; branchlets often with protruding warty short-shoots which carry the *inflorescences*. Petiole 0.5–1.5 cm, ± angular, with scattered hairs; pinnae and petiolules scarcely puberulous; leaflets drying light brown to grey-brown, 5.5–12.5 by 1.5–4.3 cm; principal lateral veins 7–13 per leaflet-half, parallel, ± straight in narrow leaflets. *Inflorescences* terminal or ramiflorous; panicles up to 5 cm long. *Pod* c. 6 cm long, 0.6–1 cm wide. Seeds 9 by 7 by 3 mm (seen in one specimen only).

Distribution – *Malesia*: Philippines.

Habitat & Ecology – Forested slopes, c. 500 m.

**23. *Archidendron sabahense*** Nielsen, Opera Bot. 76 (1984) 64, f. 33, 35.

Small tree to c. 9 m high, girth c. 30 cm. Branchlets terete, puberulous in the distal parts, glabrescent. *Leaves*: rachis 5–16 cm, puberulous, gland(s) urceolate with a narrow orifice, c. 2 mm in diameter; pinnae 1 or 2 pairs, (2–)4–11(–14.5) cm, puberulous; petiolules 1–4 mm, puberulous; leaflets (1–)3 pairs per pinna, opposite, coriaceous, drying brown or green above, olive-green beneath,  $\pm$  unequal-sided, ovate, elliptic, obovate-elliptic, or trapezoid-lanceolate, (5.5–)6–24 by (2.5–)3–10.5 cm, base asymmetrically cuneate, apex narrowly obtuse to acuminate, upper surface glabrous except for puberulous main vein, lower surface puberulous; principal lateral veins 8(–14) per leaflet-half, parallel,  $\pm$  arching; reticulation lax, prominulous above, prominent and raised beneath. *Inflorescences* terminal and axillary at the distal leaves, very densely puberulous, consisting of pedunculate glomerules aggregated into panicles, 30 by 28 cm; glomerules consisting of c. 5 sessile flowers; floral bracts elliptic-oblong, c. 2 mm, sericeous. *Flowers* pentamerous, bisexual, white, sweetly scented. Calyx broadly cup-shaped, 4–5.5 mm, densely puberulous to sericeous, teeth  $\pm$  irregular, triangular, acute, 0.5–1.5 mm. Corolla funnel-shaped, 10–12 mm, sericeous; lobes ovate-elliptic, acute; 4–5.5 mm. *Stamens* 25–30 mm, tube equalling the corolla-tube. Ovary solitary, sericeous. *Pod* brownish outside, deep reddish inside, contorted into a lax spiral, to c. 13 by 1.8–2 cm, rigidly chartaceous, not or only slightly sinuate between the seeds, short-puberulous, veins inconspicuous, dehiscing first along the ventral suture. *Seeds* black, ellipsoid, flattened, 14–15 by 11–12 by 6–8 mm.

Distribution – *Malesia*: Borneo (Sabah).

Habitat & Ecology – Primary rain forest, on slopes and crests; alt. 30–300 m. Fl. Mar., fr. May.

**24. *Archidendron scutiferum*** (Blanco) Nielsen, Opera Bot. 76 (1984) 46. — *Mimosa scutifera* Blanco, Fl. Filip. (1837) 735, p.p.; ed. 2 (1845) 507; ed. 3, 3 (1879) 138, t. 438. — *Pithecellobium scutiferum* (Blanco) Benth., Lond. J. Bot. 3 (1844) 211. — *Abarema scutifera* (Blanco) Kosterm., Bull. Organ. Natuurw. Onderz. Indon. 20 (1954) 63, p.p.; Add. Not. Mimos. (1956) 4; Adansonia sér. 2, 6 (3) (1966) 358.

*Pithecellobium lobatum* auct. non Benth.: Benth., Trans. Linn. Soc. 30 (1875) 575, p.p., quoad syn. *Mimosa scutifera* (Blanco) Benth.

Shrub or medium-sized tree to 20 m high, d.b.h. up to 60 cm. Branchlets terete, with low decurrent ridges from the leaf-scars, glabrous, inconspicuously lenticellate. *Leaves* glabrous all over; petiole 1.5–9.5 cm, with one gland, (circular-)linear or slit-like, sessile, often with a central depression, 2–7 mm long; pinnae 1 pair, 4.5–18 cm, petiolules 3–8 mm long; leaflets 2 or 3 (or 4) pairs per pinna, opposite, proximal pair sometimes subopposite, rigidly chartaceous, drying dark green to blackish above and light green or grey beneath,  $\pm$  equal-sided, ovate-elliptic, broadly elliptic or lanceolate, (4.3–)6–24 by 2–9.8 cm, base asymmetrically cuneate, apex acuminate with obtuse tip; principal lateral veins 3–11 per leaflet-half, non parallel, arching, the lower vein but one arching upwards to beyond the middle of the leaflet, reticulation prominulous above, prominent beneath. *Inflorescences* either ramiflorous below the leaves, or axillary at the distal leaves, puberulous to sericeous, consisting of pedunculate glomerules, aggregated into panicles to 25 by 12 cm; glomerules consisting of 6 (sub)sessile flowers; floral bract deltoid, 0.5–1 mm long, puberulous. *Flowers* pentamerous, bisexual. Calyx broadly cup-shaped, 1.2–2.5 mm long, glabrous; teeth broadly triangular, (sub)obtuse, 0.2–0.5 mm long, scarcely ciliate along the margin. Corolla greenish white, broadly funnel-shaped, 4–6 mm long, glabrous; lobes ovate or ovate-elliptic, acute, 2–2.8 mm long. *Stamens* white, 5–10 mm, tube equalling or longer than the corolla-tube. Ovary solitary, glabrous, shortly stipitate (stipe up to 0.5 mm long). *Pod* yellowish red, pink or scarlet outside, reddish orange within, contorted, (halfway or) completely sinuate along the ventral suture, the segments separated by constrictions, thinly woody, up to 40 cm long, (1.8–)2.5–3.8 cm wide across the seeds, segments 2–2.8 cm wide, suborbicular, glabrous, swollen, veins inconspicuous, dehiscing along the ventral suture. *Seeds* steel-blue, covered by a bloom, ellipsoid to orbicular, 13–18 by 9–10 mm.

Distribution – *Malesia*: Philippines.

Habitat & Ecology – Primary and secondary forest; altitude 0–900 m. Fl., fr. throughout the year.

**25. *Archidendron trichophyllum*** (Kosterm.) Nielsen, Opera Bot. 76 (1984) 70, f. 40, 41. — *Pithecellobium trichophyllum* Kosterm., Reinwardtia 3 (1954) 15. — *Abarema trichophylla* (Kosterm.) Kosterm., Bull. Organ. Natuurw. Onderz. Indon. 20 (1954) 53, p.p.; Adansonia sér. 2, 6 (3) (1966) 359.

Tree to 6 m high. Branchlets terete, brown, puberulous, in the ultimate parts ferrugineously hirsute, glabrescent. *Leaves*: rachis 17 cm, rusty puberulous or villous, glands elliptic to semi-globose, raised, 3–4 mm long; pinnae 2 pairs, 7–17 cm, densely rusty puberulous or villous; petiolules 2–5 mm, densely puberulous or villous; leaflets (1–)3 or 4 pairs per pinna, opposite, rigidly chartaceous, drying dark brown above, yellowish green beneath, unequal-sided to nearly equal-sided, ovate-elliptic, obovate-elliptic, broadly elliptic, or oblong, (4–)7–18.5 by (2.5–)3–7.5 cm; base symmetrically or asymmetrically cuneate, apex acuminate-caudate; upper surface glabrous, lower surface densely appressed puberulous, veins ferrugineously hirsute, and with few minute glands near the main vein; principal lateral veins 7 or 8 per leaflet-half, non-parallel, arching; reticulation lax, prominulous above, prominent beneath. *Inflorescence* terminal, rusty hirsute-velutinous, consisting of pedunculate glomerules aggregated into panicles, 40 by 18 cm; glomerules of consisting 3 or 4 sessile flowers; floral bracts inconspicuous. *Flowers* pentamerous, bisexual. Calyx cup-shaped or subcampanulate, 2–3 mm, villous; teeth broadly ovate, acute, to 1 mm. Corolla yellowish-white, narrowly funnel-shaped, (5–)6–8 mm, proximal part of tube glabrous, distal part and lobes appressedly puberulous or delicately sericeous; lobes triangular-ovate, acute, 3 mm. *Stamens* white, to 18 mm, tube 4 mm long, slightly shorter than the corolla-tube. Ovary solitary, sericeous. *Pod* red-brown outside, reddish-orange within, curved into a circle, 6–10 cm in diameter, valves to 3.5 cm wide, coriaceous, sinuate or not, short-puberulous, veins prominulous, dehiscing first along the ventral suture. *Seeds* bluish black, ellipsoid, only slightly flattened, c. 20 by 12 mm.

Distribution – *Malesia*: Sumatra, Bangka.

Habitat & Ecology – Rain forest, ravines; altitude 150–850 m. Fl. Aug.; fr. Nov.

Taxonomy – Closely related to *A. globosum* (Nielsen, l.c.).

- 26. *Archidendron triplinervium*** (Kosterm.) Nielsen, Opera Bot. 76 (1984) 66, f. 36, 37. — *Abarema triplinervia* Kosterm., Bull. Organ. Natuurw. Onderz. Indon. 20 (1954) 74; Kosterm., Adansonia sér. 2, 6 (3) (1966) 359. — *Pithecellobium triplinervium* (Kosterm.) Cockb., Trees Sabah 1 (1976) 196, comb. inval.

*Cylindrokelupha havilandii* auct. non (Ridley) Kosterm.: Kosterm., Bull. Organ. Natuurw. Onderz. Indon. 20 (1954) 22, p.p.

Tree (or shrub), 4.5–10(–26) m high; bole to 14 m high, 40 cm in diameter. Branchlets terete or ± angular in the distal part, yellowish grey to light brown, glabrous. *Leaves*: rachis 1.5–7.5 cm, glabrous, gland broadly to narrowly elliptic, flat or slightly cushion-shaped, often ± raised, 2–9 mm; pinnae 1 pair, 3.5–13.5 cm, glabrous; petiolules 2–7 mm, glabrous; leaflets 2 (or 3) pairs per pinna, opposite, coriaceous or chartaceous, drying grey-green or brown, ± equal-sided, ovate-elliptic to obovate-elliptic (or lanceolate), (4–)7.5–18 by (2.5–)4.5–8.5 cm, base symmetrically rounded or broadly cuneate, apex obtusely acuminate-caudate, both surfaces glabrous; principal lateral veins (1–)2–3(–4) per leaflet-half, non parallel, strongly arching, issuing from the lower half of the main vein; reticulation lax, prominulous above, prominent beneath. *Inflorescences* terminal or ramiflorous below the leaves, scarcely puberulous, glabrescent, consisting of pedunculate glomerules aggregated into panicles, 30 by 35 cm; glomerules consisting of 2 or 3 sessile or subsessile flowers; pedicel less than 1 mm; floral bracts ovate, obtuse or obscurely dentate, c. 1 mm, glabrous. *Flowers* pentamerous, bisexual. Calyx green, cup-shaped or campanulate, (1.5–)2.4–4.5 mm, glabrous; teeth deltoid, irregular, acute, 0.1–0.8 mm. Corolla yellowish green or white, funnel-shaped, 6–10 mm, glabrous; lobes elliptic, acute, (2.5–)3–4 mm. *Stamens* white, c. 25 mm, tube equalling or shorter than the corolla-tube. Ovary solitary, glabrous. *Pod* red or brownish outside, reddish orange within, curved into a circle 6–10 cm in diameter, valves 2.5–3.5 cm wide, coriaceous-chartaceous, not sinuate, glabrous, veins inconspicuous, dehiscing first along the ventral suture. *Seeds* bluish black, ellipsoid, slightly flattened, c. 15 by 10 mm.

Distribution – *Malesia*: Borneo.

Habitat & Ecology – Primary and secondary rain forest, seasonally inundated forest; found on riverbanks and low and undulating terrains, occasionally on slopes and ridges; altitude 0–150 m, occasionally up to 1200 m. A montane, shrubby ecotype from poor soil has been found in Sabah (Nielsen, l.c.).

Uses – Rubbed young shoots mixed with water have been used against malaria.



## 2. Series Archidendron

Stipules, stipular scars, and stipular glands usually present. Petiole not winged. Leaflets opposite, petiolulate. *Inflorescences* erect, paniculate, cauliflorous or terminal; inflorescence-units either racemes, umbels, or glomerules; floral bracts without nectary (in Malesia). *Flowers* bisexual or male and female. Calyx neither inflated nor strongly ribbed. Staminal tube longer than the corolla-tube, often as long as or longer than the corolla. Ovaries 1–15 per flower, sessile. *Pods* fleshy-coriaceous, usually spirally contorted, rarely straight, sinuate or not sinuate along the dorsal suture (along the ventral suture in one species), dehiscent first along the dorsal suture (along the ventral suture in one species). *Seeds* often imbedded in the pericarp, giving the pod a segmented appearance internally.

Distribution — About 15 species, of which 11 in *Malesia*: Lesser Sunda Islands, Celebes, Moluccas, New Guinea, Solomon Islands (1) and Australia (6).

Morphology & Taxonomy — Extensively reviewed by Nielsen, Baretta-Kuipers & Guinet [Opera Bot. 76 (1984) 5–120]. Species of this series have mainly been referred to *Archidendron*, a few were referred to *Abarema* by Kostermans [Bull. Organ. Natuurw. Onderz. Indon. 20 (1954)].

Note — For the Keys to the species (I: flowering, and II: fruiting material), see p. 88 and p. 92, respectively.

### 27. *Archidendron arborescens* (Kosterm.)

Nielsen, Opera Bot. 76 (1984) 80, f. 53, 54. — *Pithecellobium arborescens* Kosterm., Reinwardtia 3 (1954) 17. — *Abarema arborescens* (Kosterm.) Kosterm., Bull. Organ. Natuurw. Onderz. Indon. 20 (1954) 58; Verdc., Manual New Guin. Legum. (1979) 213.

*Abarema novo-guineense* auct. non (Merr. & Perry) Kosterm.: Kosterm., Adansonia sér. 2, 6 (3) (1966) 358, p.p., quoad *Brass* 8176.

Tree to 30 m high. Branchlets terete, brownish, distal parts densely puberulous by brown hairs. Stipules and stipular glands not seen. *Leaves*: rachis 9–17 cm, puberulous, gland  $\pm$  circular to transversely elliptic, flat, sessile, 1–2 mm in diameter; pinnae 1 or 2 pairs, 8.5–19.5 cm, puberulous, glands subcircular, flat, sessile, 1–2 mm in diameter; petiolules 2–4 mm, puberulous; leaflets 3 or 4 pairs per pinna, opposite, rigidly chartaceous, drying brownish, often unequal-sided, ovate, elliptic, or obovate-elliptic, (3.5–)9–15 by 3.5–8.5 cm, base truncate or cuneate basiscopically, rounded or subcordate acroscopically, apex obscurely acuminate, upper surface with a few scattered hairs on the main veins, lower surface with puberulous veins or glabrous (or with a few scattered hairs only); principal lateral veins 5 or 6 per leaflet-half, arching, non-parallel; reticulation dense,

prominent on both surfaces. *Inflorescences* terminal, densely puberulous, consisting of pedunculate glomerules aggregated into panicles to 40 by 40 cm; glomerules consisting of 6–8 sessile flowers; floral bracts triangular-ovate, 0.5 by 1 mm, puberulous. *Flowers* pentamerous, bisexual. Calyx olive-brown, narrowly campanulate, 2.5–3.5 mm, densely puberulous; teeth broadly triangular, acute, c. 0.2 mm. Corolla pale-green, funnel-shaped, 6–9 mm, sericeous; lobes oblong, acute, 2–2.5 mm. *Stamens* white, up to 20 mm, tube equalling the corolla-tube. Ovary solitary, pilose, subsessile. *Pod* orange outside, reddish inside, curved into a semi-circle or a circle, up to 10 cm long and 1.5 cm wide, fleshy, tomentose, strongly bullate over the seeds, lobed along the dorsal suture, veins inconspicuous, dehiscent first along the dorsal suture. *Seeds* black, ovate-ellipsoid, c. 12 by 4 mm.

Distribution — *Malesia*: Papua New Guinea.

Habitat & Ecology — Dry rain forest, montane forest; altitude 0–1260 m. Fl. Oct., fr. Nov. or Apr.–May.

Field notes — Bole spur-buttressed at the base. Bark dark grey, tessellated, middle vine red, inner cream; wood creamy brown, hard and heavy, becoming red-brown.

Note — The collections from montane areas have short peduncles, up to 2.5 mm; the normal length of the peduncles is up to 5 mm long.

**28. *Archidendron beguinii*** De Wit, Bull. Bot. Gard. Buitenzorg 17 (1942) 262; Reinwardtia 2 (1952) 77; Nielsen, Opera Bot. 76 (1984) 80, f. 49, 50. — *Pithecellobium beguinii* (De Wit) Mohlenbr., Webbia 21 (1966) 692, f. 18.

*Archidendron effeminatum* auct. non De Wit: Kosterm., Reinwardtia 3 (1954) 24, p.p., quoad syn. *A. beguinii* De Wit.

Tree to 7 m high. Branchlets terete, scarcely puberulous, glabrescent. Stipules not seen. *Leaves*: rachis 25–85 cm, scarcely puberulous; gland narrowly elliptic, sessile, sunken, without raised margins, flat when old, 2.5–7 mm; pinnae 3 or 4 pairs, (2–)9–49 cm, scarcely puberulous; petioles 2–7 mm, black, glabrous; leaflets (2–)5–6 pairs per pinna, opposite, chartaceous, drying grey or green,  $\pm$  unequal-sided, ovate-elliptic or broadly elliptic, (5.8–)12.5–23 by (2.6–)8–10.6 cm, base  $\pm$  asymmetrically broadly cuneate to rounded but shortly decurrent in the basiscopic portion, apex short-acuminate, mucronulate, both surfaces glabrous; principal lateral veins 4–6 per leaflet-half, arching; reticulation prominulous above, prominent beneath. *Inflorescence* cauliflorous, glabrous, a simple or scarcely branched raceme to 3 cm, with the flowers congested near the apex; pedicels 0.5–5 mm, glabrous; bracts inconspicuous. *Flowers* white, pentamerous, bisexual. Calyx narrowly campanulate or tubular, glabrous, (13–)20 mm, irregularly dentate; teeth broadly triangular, obtuse, to 3 mm. Corolla tubular, (35–)40–45 mm, glabrous; lobes oblong, recurved, broadly acute, 8–13 mm. *Stamens* to 75 mm; tube exserted. Ovaries 3, glabrous. *Pod* reddish outside, orange within, densely contorted, 8.5–24 by 1.5–3 cm, fleshy, sinuate, glabrous, wrinkled, veins inconspicuous. *Seeds* imbedded in the fleshy pericarp, not seen.

*Distribution* – *Malesia*: Moluccas (Halmahera, Ternate).

*Note* – The type, *Beguin* 2263, seems to be a sapling which may be the cause of its very large leaflets, 27 by 10.5 cm. The species is reduced to *A. effeminatum* (= *A. lucyi*) by Kostermans, but glands, inflorescence, flowers and pods are different.

**29. *Archidendron grandiflorum*** (Soland. ex Benth.) Nielsen, Nordic J. Bot. 2 (1982) 481, f. 1; Opera Bot. 76 (1984) 80, f. 51. — *Pithecellobium grandiflorum* Soland. ex Benth., Fl. Austral. 2 (1864) 424. — *Abarema grandiflora* (Soland. ex Benth.) Kosterm., Bull. Organ. Natuurw. Onderz. Indon. 20 (1954) 34, f. 20; Adansoniasér. 2, 6 (3) (1966) 356; Verdc., Manual New Guin. Legum. (1979) 215, f. 57.

*Pithecellobium tozeri* F. Muell., Fragm. 5 (1865) 10. — *Albizia tozeri* (F. Muell.) F. Muell., J. Bot. 10 (1872) 10. — *Feuillea tozeri* (F. Muell.) O. Kuntze, Rev. Gen. Pl. 1 (1891) 187.

Tree 3–24 m high, bole 6–15 m high. Branchlets terete, puberulous, glabrescent. Stipules filiform, 1–2 mm, densely puberulous, caducous. *Leaves*: rachis (2.3–)6–17 cm, puberulous, gland narrowly conical, often hollow, pointing distally, 1–1.5(–5) mm high; pinnae (1–)2–4 pairs, puberulous, (1.8–)2.5–15(–16.8) cm, glands smaller but similar to rachis glands; petioles c. 4 mm, glabrous; leaflets 2–5 pairs per pinna, opposite, chartaceous, drying dark green above, light green beneath, often unequal-sided, ovate, ovate-elliptic, elliptic-lanceolate, or obovate-elliptic, (1.8–)3.1–8.6(–11.5) by (0.6–)1.5–4.4 cm, base  $\pm$  symmetrical, broadly cuneate or rounded, apex acuminate(–caudate), mucronulate, both surfaces glabrous or rarely scarcely puberulous along the main vein; principal lateral veins c. 5 or 6 per leaflet-half, arching; reticulation dense on both surfaces. *Inflorescence* terminal or axillary at the distal leaves,



Fig. 15. *Archidendron grandiflorum* (Soland. ex Benth.) Nielsen. Seedling; a. leaves with unifoliate pinnae; b. leaves with trifoliate pinnae; c. cotyledons (89 BI 00472, Coffs Harbour, Australia, cult. AAU).

± densely puberulous, consisting of pedunculate head-like spikes aggregated into racemes or panicles to 18 cm; spikes consisting of c. 10 flowers, pedicels to 2 mm, floral bracts spatulate, 3–5 mm, sericeous. *Flowers* pentamerous, bisexual. Calyx green, campanulate, (5.5–)6.5–9(–10) mm, puberulous, sometimes deeply bifid, teeth deltoid, c. 0.2 mm. Corolla white or yellow, funnel-shaped, (18–)21–25 mm, sericeous, usually bifid at the apex; lobes rarely separating, elliptic to lanceolate, acute, 5–7 mm. *Stamens* c. 45 mm, tube exerted, yellow, free part of filaments red. Ovary solitary, glabrous. *Pod* reddish-brown outside, bright orange within, curved into a semi- to full circle, to c. 6 cm in diameter, valves 1.5–2.5 cm wide, thinly woody, not sinuate, glabrous, veins inconspicuous, dehiscing along the dorsal suture. *Seeds* bluish-black, glossy, obovoid-ellipsoid, 12–14 by 8–10 mm. — **Fig. 15.**

Distribution — Australia (Queensland, New South Wales); in *Malesia*: New Guinea.

Habitat & Ecology — Rain forest, secondary regrowth, rain forest mangrove transition zone; altitude 5–250 m.

Field notes — Bark fawn, brown and grey, patchy, ± rough due to minor cracking and vertical ridging; inner bark orange-red; sapwood cream to straw; heartwood reddish.

### 30. *Archidendron harmsii* v. Malm, Notizbl.

Berlin-Dahlem 11 (1932) 629; De Wit, Bull. Bot. Gard. Buitenzorg 17 (1942) 266; Reinwardtia 2 (1952) 29 (sub species excl.); Nielsen, Opera Bot. 76 (1984) 78, f. 47, 48. — *Pithecellobium harmsii* (v. Malm) Kosterm., Reinwardtia 3 (1954) 7. — *Abarema harmsii* (v. Malm) Kosterm., Bull. Organ. Natuurw. Onderz. Indon. 20 (1954) 33; Reinwardtia 6 (1962) 161, f. 6.

Tree to 25 m high, to 40 cm in diameter. Branchlets terete, glabrous, lenticellate. Stipules and stipular glands absent. *Leaves*: rachis 1–7.5 cm, glabrous; glands ± circular, flat, sessile, often sunken, without raised margins, 1–3 mm in diameter; pinnae 1 pair, 4–17 cm, glabrous; petiolules 4–5 mm, glabrous; leaflets 1½–3 pairs per pinna, opposite, the lower leaflet sometimes unpaired, rigidly chartaceous-coriaceous, drying grey-green, equal-sided, broadly elliptic, 3.7–17 by 2–11 cm, base symmetrically cuneate, somewhat tapering, apex rounded or obscurely acuminate, both surfaces glabrous; principal lateral veins 4 or 5 per leaflet-half, arching, reticulation prominent on both surfaces. *Inflorescences* terminal or axillary at the distal leaves, glabrous, consisting of pedunculate umbels

aggregated into panicles to 10 cm; peduncles 1–2 cm, umbels consisting of up to 8 pedicellate flowers, pedicels 3–5 mm, floral bracts ovate, broadly acute, 1–2 mm, glabrous. *Flowers* tri- or tetramerous, female or bisexual. Calyx green, broadly tubular or narrowly campanulate, 7–11 mm, glabrous; lobes ovate, obtuse, c. 1–2 mm, or calyx occasionally split further down. Corolla green, narrowly funnel-shaped, 22.5–30 mm, glabrous; lobes oblong-lanceolate, acute, often unequal, 6–8 mm. *Stamens* white, to 40 mm, tube equalling the corolla. Ovary solitary, glabrous, sessile. *Pod* bright red, slightly curved, flattened or subterete, 4.5–9 by 1.7–2.5 cm, coriaceous or woody, sometimes constricted between the seeds due to abortion of some ovules, glabrous, veins inconspicuous, dehiscing along both sutures. *Seeds* black, ellipsoid, c. 15 by 10 mm.

Distribution — *Malesia*: Lesser Sunda Islands (Sumbawa, Sumba, Flores).

Habitat & Ecology — Scattered in lower montane forest, moist *Dipterocarpus retusus*-forest on andesite; altitude 500–1210 m. Fl. May.

Field notes — Bark roughish, grey-brown, inner bark straw; sapwood dirty white, heartwood dark red-brown.

Taxonomy — For notes on the position of this species in ser. *Archidendron* see Nielsen, Baretta-Kuipers & Guinet [Opera Bot. 76 (1984) 26].

### 31. *Archidendron kalkmanii* (Kosterm.)

Nielsen, Opera Bot. 76 (1984) 84, f. 53, 54. — *Abarema kalkmanii* Kosterm., Adansonia sér. 2, 6 (3) (1966) 365, pl. 4; Verdc., Manual New Guin. Legum. (1979) 216. — Type: *Kalkman BW 3602* (BO holo; L, LAE iso).

*Pithecellobium dewitianum* Mohlenbr., Webbia 21 (1966) 710, pl. 28. — Type: *Kalkman BW 3602* (L holo; BO, LAE iso).

Tree up to 10 m high. Branchlets terete, greyish, lenticellate, puberulous in the distal parts, glabrescent. Stipules or stipular glands not seen. *Leaves*: rachis up to 22 cm, shortly puberulous; glands circular, sessile, ± raised, depressed in the central part, c. 1.5 mm in diameter; pinnae (1–)3–4 pairs, puberulous, up to 20 cm, glands ± circular, sessile, flat, c. 1 mm in diameter; petiolules 3–4 mm, densely puberulous; leaflets 3 or 4 pairs per pinna, opposite, chartaceous, drying greyish brown, unequal-sided, very broadly ovate or ovate-elliptic, 4–10 by 3–7 cm; base symmetrically cuneate or cuneate in the basiscopic part, rounded in the acroscopic part, apex acuminate; both surfaces puberulous, especially on the veins; principal lateral



veins 5 or 6 per leaflet-half, arching, non-parallel; reticulation dense and prominent on both surfaces. *Inflorescence* terminal, densely rusty puberulous, consisting of pedunculate glomerules, aggregated into panicles up to 33 cm, glomerules consisting of 6–10 subsessile flowers; floral bracts not seen. *Flowers* pentamerous, bisexual. Calyx greenish brown, broadly campanulate, 2–2.5 mm, tomentose; teeth inconspicuous. Corolla greenish white, narrowly funnel-shaped, with a long narrow tube, 12–14 mm, rusty tomentose; lobes oblong, acute, 3–4 mm. *Stamens* to 30 mm, tube equalling the corolla-tube. Ovary(-ies) 1 (or 2), sericeous, sessile. Pod and seeds not known.

Distribution – *Malesia*: West Irian (Jayapura).

Habitat & Ecology – Secondary forest in sloping country, stony soil; altitude 50–70(–430?) m. Fl. Sep.

Note – Flowering material only known from the (fragmentary) type.

**32. *Archidendron lucyi*** F. Muell., *Fragm.* 6 (1868) 201; De Wit, *Bull. Bot. Gard. Buitenzorg* 17 (1942) 268; Reinwardtia 2 (1952) 86; Verdc., *Manual New Guin. Legum.* (1979) 242, f. 59; Nielsen, *Nordic J. Bot.* 2 (1982) 484, f. 5; *Opera Bot.* 76 (1984) 80, f. 49. — *Pithecellobium lucyi* (F. Muell.) F. Muell., *Fragm.* 6 (1868) 201, '*Pithecolobium*'; Mohlenbr., *Webbia* 21 (1966) 695, f. 20. — *Albizia lucyi* (F. Muell.) F. Muell., *Icon. Austral. Spec. Acacia* Dec. 13 (1888) pl. 6. — *Affonsea lucyi* (F. Muell.) O. Kuntze, *Rev. Gen. Pl.* 1 (1891) 15.

*Archidendron chrysocarpum* K. Schum. & Lauterb., *Fl. Deut. Schutzgeb. Südsee* (1900) 344; De Wit, *Bull. Bot. Gard. Buitenzorg* 17 (1942) 265; Reinwardtia 2 (1952) 81; Verdc., *Manual New Guin. Legum.* (1979) 235. — *Pithecellobium chrysocarpum* (K. Schum. & Lauterb.) Mohlenbr., *Webbia* 21 (1966) 692, f. 19.

*Archidendron solomonense* Hemsley, *Hook. Icon. Pl.* (1902) t. 2735; De Wit, *Bull. Bot. Gard. Buitenzorg* 17 (1942) 271; Reinwardtia 2 (1952) 94; Verdc., *Manual New Guin. Legum.* (1979) 252. — *Pithecellobium solomonense* (Hemsley) Mohlenbr., *Webbia* 21 (1966) 699, f. 21.

*Archidendron peekelii* Lauterb., *Bot. Jahrb.* 45 (1911) 360; De Wit, *Bull. Bot. Gard. Buitenzorg* 17 (1942) 270.

*Archidendron schlechteri* Harms, *Bot. Jahrb.* 55 (1917) 40; Merr. & Perry, *J. Arnold Arbor.* 23 (1942) 391; De Wit, *Bull. Bot. Gard. Buitenzorg* 17 (1942) 270. — *Archidendron lucyi* F. Muell. var. *schlechteri* (Harms) De Wit, *Reinwardtia* 2 (1952) 93.

*Archidendron sogerense* Baker f., *J. Bot.* 61 (1923) Suppl. 12; De Wit, *Bull. Bot. Gard. Buitenzorg* 17 (1942) 271; Reinwardtia 2 (1952) 93.

*Archidendron effeminatum* De Wit, *Bull. Bot. Gard. Buitenzorg* 17 (1942) 265; Reinwardtia 2 (1952) 82.

*Archidendron papuanum* Merr. & Perry, *J. Arnold Arbor.* 23 (1942) 392.

*Archidendron beguinii* auct. non De Wit: Kosterm., *Reinwardtia* 3 (1954) 24, p.p., quoad syn. *A. effeminatum* De Wit.

Much-branched shrub or tree, 2.4–8(–20) m high, bole to 13 m tall, to 60 cm in diameter. Branchlets terete, greenish, glabrous. Stipules absent but stipular glands present. *Leaves*: rachis 10–55 cm, glabrous, with one gland, circular or elliptic, usually depressed, without raised margins, 1–4 mm long; pinnae 2–3(–4) pairs, to 12 cm long, glabrous, glands circular, 1–2 mm in diameter, with depressed central part, margins sometimes ± raised and swollen; petiolules black, 4–5 mm, glabrous; leaflets (1–)2–4 pairs per pinna, opposite, coriaceous, drying glossy pale yellowish green, unequal-sided, ovate, elliptic, obovate-elliptic, or lanceolate, (5.2–)7–18(–23) by 3.5–9(–15) cm, base slightly asymmetrical, broadly cuneate to subtruncate, apex acuminate, both surfaces glabrous, principal lateral veins (4–)6–7 per leaflet-half, arching, non-parallel; reticulation dense, prominent on both surfaces. *Inflorescences* usually cauliflorous or ramiflorous, sometimes terminal, glabrous, consisting of pedunculate umbels aggregated into racemes or panicles to 30 cm long; umbels 2–5-flowered; pedicels 2–7 mm; floral bracts absent. *Flowers* pentamerous, bisexual or possibly also male or female. Calyx greenish or dark glossy green, tubular or broadly campanulate, (5.5–)6–12 mm, glabrous; teeth broadly triangular, acute, up to 3 mm. Corolla white or greenish yellow, tubular or narrowly funnel-shaped, (17–)20–35 mm, glabrous; lobes curved backwards, triangular-ovate or oblong, acute, (4–)7–10 mm. *Stamens* silky-white, 40–75 mm, tube exerted. Ovaries 2–6, glabrous. *Pod* ± red outside, orange within, nearly straight or contorted into a circle, 10–20 cm long, 2(–3) cm wide, woody or fleshy, divided into (nearly) separate compartments, sinuate, glabrous, veins inconspicuous, pod dehiscing along the dorsal suture (or possibly indehiscent). *Seeds* black or bluish-black with a whitish bloom, obovoid or ellipsoid, ± compressed, c. 10–16 by 8–10 mm.

Distribution – Solomon Islands, Australia (Queensland); in *Malesia*: Moluccas (Ceram), Kai Islands, New Guinea, Bismarck Archipelago.

**Habitat & Ecology** – Primary and secondary rain forest, often riverine forest; usually on well-drained soils. The most common of the large-flowered species; altitude up to 1500 m. Fl., fr. throughout the year.

**Field notes** – Bark smooth or rough with longitudinal fissures, reddish, grey-green, grey-brown or mottled green and fawn, with round pale pustular lenticels; inner bark straw; wood soft to medium hard, straw, darker towards the heartwood, rarely pinkish red.

**Taxonomy** – A rather variable species. Specimens from New Britain have terminal inflorescences and subcarinate pods. Specimens formerly described as *A. chrysocarpum* have greenish-yellow pods. Because the variation seems to be in single characters only no subspecific categories have been proposed (cf. Nielsen 1982: 485).

### 33. *Archidendron muricarpum* (Kosterm.)

Verdc., Kew Bull. 32 (1977) 230; Manual New Guin. Legum. (1979) 246; Nielsen, Opera Bot. 76 (1984) 84, f. 55, 56. — *Abarema muricarpa* Kosterm., Adansonia sér. 2, 6 (3) (1966) 365, pl. 2. — Type: NGF 8612 (BO holo; A, BM, L, LAE, SING iso).

*Pithecellobium muricatum* Mohlenbr., Webbia 21 (1966) 676, f. 8. — Type: NGF 8612 (LAE holo; A, BM, BO, L, SING iso).

Tree c. 10 m high. Branchlets terete, bristly rusty-hairy. Stipules linear-filiform, up to 1 cm, rusty hairy, persistent. *Leaves*: rachis 0.8–3.5 cm, with spreading, bristly ferrugineous hairs, with one gland, circular in outline, slightly concave, stalked, stalk c. 1 mm; pinnae 1 pair, 1–4(–9) cm, indumentum as on the rachis, glands not seen; leaflets subsessile, the short petiolules setose; leaflets 1–1½ pair per pinna, opposite, chartaceous drying dull brown, unequal-sided, elliptic, obovate-elliptic, or obovate-oblong, 3.5–18.5 by 1.7–8 cm, base very obliquely cuneate, apex acutely acuminate, both surfaces rusty setose; principal lateral veins 6 or 7 per leaflet-half, slightly arching, non-parallel; reticulation faint, impressed above, prominent and raised beneath. *Inflorescence* only known in the fruiting stage, subterminal, hispid, possibly racemose, ?6 cm long, floral bracts not known. *Old flowers* as seen in fruiting specimens: calyx cupular, 5–7.5 mm, hispid; teeth 1–1.5 mm; corolla funnel-shaped, c. 10 mm, sericeous; lobes oblong, acute; stamens not seen; ovaries 2, sessile, glabrous. *Pod* dark red outside, reddish inside, twisted, consisting of c. 9 segments, each c. 15 by 13 mm, thinly woody, deeply constricted

along the dorsal suture, glabrous, with blunt, irregular pointed tubercles, dehiscing along both sutures. *Seeds* black, ellipsoid, c. 12 by 8 mm.

**Distribution** – *Malesia*: Papua New Guinea (Normanby Is.).

**Habitat & Ecology** – Rain forest substage; altitude 10–15 m. Fr. Apr.

**Field notes** – Bark grey-green; wood white.

**Notes** – Verdcourt (1977: 230) commented on the synonymy of this species.

The species is still poorly known and only placed tentatively in ser. *Archidendron* (cf. Nielsen, l.c.). Similar tubercular pods found in *A. hispidum* (ser. *Ptenopae*) and in the imperfectly known 'sp. V' of Verdcourt (1979: 255) from the Louisiades (Misi-ma), a species with subcordate leaflet-bases.

### 34. *Archidendron novo-guineense* (Merr. & Perry)

Nielsen, Opera Bot. 76 (1984) 84, f. 54. — *Pithecellobium novo-guineense* Merr. & Perry, J. Arnold Arbor. 23 (1942) 394. — *Abarema novo-guineense* (Merr. & Perry) Kosterm., Bull. Org. Natuurw. Ond. Indon. 20 (1954) 60; Verdc., Manual New Guin. Legum. (1979) 218.

Tree 6–9 m high. Branchlets terete, grey-brown, glabrous. Stipules and stipular glands not seen. *Leaves*: rachis 11–20 cm, glabrous, gland circular, minute; pinnae 2 pairs, glabrous, glands minute, circular, petiolules c. 3 mm, glabrous; leaflets 2–4 pairs per pinna, opposite, chartaceous, drying brownish, ± equal-sided, elliptic, obovate, or ovate-elliptic, 6–12 by 3–6 cm, base ± symmetric, rounded or cuneate, apex acuminate, both surfaces glabrous; principal lateral veins 5 or 6 per leaflet-half, arching, non-parallel; reticulation very dense, prominent on both surfaces. *Inflorescences* insufficiently known, probably axillary and puberulous, consisting of pedunculate glomerules aggregated into panicles up to 25 cm long; glomerules consisting of sessile flowers; floral bracts not seen. *Flowers* possibly tetramerous, bisexual. Calyx narrowly campanulate, 3–4 mm, shortly puberulous; teeth unequal, broadly ovate, acute, 1 mm. Corolla sub-tubular, c. 11 mm; tube glabrous; lobes oblong, acute, c. 4 mm, with scattered hairs especially near the apex. *Stamens* c. 20 mm, tube equalling the corolla-tube. Ovary(-ies) 1 (or 2), glabrous, subsessile. *Pod* red, twisted into a circle, c. 7 cm long, 0.8 cm wide, texture unknown, thickened over the seeds, possibly dehiscing along the sinuate ventral margin (Kostermans, l.c.). *Seeds* brownish, oblong, ± compressed, c. 6 by 4 mm.

**Distribution** – *Malesia*: Papua New Guinea (Central Prov., Kappa-Kappa).

Habitat & Ecology – Coastal bushland, at sea-level. Fl., fr. Dec.

Note – Only known from the type, a fragmentary specimen. Closely related to *A. arborescens*.

**35. *Archidendron syringifolium* (Kosterm.)**

Nielsen, Opera Bot. 76 (1984) 80, f. 51, 52. — *Pithecellobium syringifolium* Kosterm., Reinwardtia 3 (1954) 18, f. 7. — *Abarema syringifolia* (Kosterm.) Kosterm., Bull. Org. Natuurw. Onderz. Indon. 20 (1954) 59, f. 7; Verdc., Manual New Guin. Legum. (1979) 219.

Tree to 14.5 m high, bole to 10 m high, to 25 cm in diameter. Branchlets terete, pale brown, lenticellate, densely puberulous, glabrescent. Stipules filiform, c. 2 mm, sericeous, early caducous. *Leaves*: rachis 2.5–10 cm, densely puberulous, gland sessile, elliptic, with raised margins, concave, 2–3 mm long; pinnae 1 or 2 pairs, 4–11.5 cm, densely puberulous, glands circular, with raised margins, concave, c. 1 mm in diameter; petiolules c. 3 mm, with patent hairs; leaflets 2–4 pairs per pinna, opposite, chartaceous, drying reddish brown above, light brown beneath, unequal-sided, ovate-elliptic or ovate-oblong, 4–11 by 2–6.2 cm, base asymmetrically rounded or broadly cuneate, apex acute or acuminate, upper surface scarcely puberulous (by patent white hairs), lower surface hirsute by white hairs; principal lateral veins 5 or 6 per leaflet-half, non-parallel, slightly arching; reticulation prominulous above, raised beneath. *Inflorescences* terminal, densely puberulous, consisting of pedunculate glomerules aggregated into a panicle to 20 by 32 cm; glomerules consisting of more than 20 sessile flowers; floral bracts spoon-shaped, obtuse, c. 2 mm, tomentose. *Flowers* pentamerous, bisexual. Calyx narrowly funnel-shaped, 5–6 mm, shortly tomentose; teeth triangular, acute, c. 1 mm. Corolla cream, funnel-shaped, 15–18 mm, sericeous, often irregularly split, lobes oblong-linear, acute, 3–5 mm. *Stamens* cream, to 30 mm; tube shorter than the corolla but longer than the corolla-tube. Ovary solitary, subsessile, glabrous. Pod and seeds unknown.

Distribution – *Malesia*: Papua New Guinea (W Prov.).

Habitat & Ecology – Rain forest, at edge of sago-swamp; altitude 0–50 m. Fl. Sep.

Field notes – Bark rough, brown, decorticate in irregular fragments, red-brown underneath; blaze pale brown, sapwood cream, heartwood contrasting dark brown.

Note – NGF 34141 recorded by Verdcourt (l.c.: 220) as *Abarema* sp. probably belongs here.

**36. *Archidendron tjendana* (Kosterm.) Nielsen**, Opera Bot. 76 (1984) 79, f. 47, 48. — *Pithecellobium tjendana* Kosterm., Reinwardtia 3 (1954) 8. — *Abarema tjendana* (Kosterm.) Kosterm., Bull. Organ. Natuurw. Onderz. Indon. 20 (1954) 33, f. 19.

Small to medium-sized tree, 6–22 m high, bole to 15 m high, to 40 cm in diameter. Branchlets terete, glabrous. Stipules or stipular scars not seen. *Leaves*: rachis 0.6–5 cm, glabrous, glands circular, sessile, with slightly raised margins and depressed central part, 0.5–0.8 mm in diameter; pinnae 1 pair, glabrous; petiolules 2–4 mm, glabrous; leaflets 1½–2 pairs per pinna, drying grey-green and glossy, rigidly chartaceous-coriaceous, equal-sided, ovate-elliptic, (2–)4–20 by 1.5–9 cm, base symmetrically cuneate, apex rounded or obscurely acuminate, both surfaces glabrous, principal lateral veins 4 or 5 per leaflet-half, arching, reticulation prominent on both surfaces. *Inflorescences* terminal, glabrous, consisting of pedunculate umbels, aggregated into racemes or corymbs; peduncles solitary or paired, 1.7–6 cm; umbels 15–18-flowered; pedicel 5–10 mm; floral bracts ovate, c. 0.5 mm, inconspicuous. *Flowers* trimerous, possibly bisexual. Calyx green, subtubular or very narrowly campanulate, often deeply 2-lobed, 4–8 mm, glabrous, lobes ± irregular, ovate, obtuse-rounded, 2 mm. Corolla white, funnel-shaped, 9–12 mm, glabrous; lobes oblong, acute, 3–5 mm. *Stamens* white, to 25 mm, tube longer than the corolla-tube, shorter than the corolla. Ovary solitary, glabrous, subsessile (stipe c. 0.5 mm), surrounded by a nectary at base. *Pod* reddish brown outside, reddish inside, slightly curved, subcylindrical, 13–18 by 1.8–2 cm, woody-coriaceous, slightly constricted between the seeds, glabrous, veins inconspicuous, pod dehiscing first along the dorsal suture. *Seeds* black, irregular-elliptic, compressed, somewhat truncate in the parts adjacent to other seeds, 11–17 by 8–12 mm.

Distribution – *Malesia*: Celebes (Malili region).

Habitat & Ecology – Lowland forest, secondary forest on limestone; altitude up to 600 m. Fl. Sep.–Oct., fr. Dec.

Field notes – Bark smooth, dark red-brown, inner bark pale yellow; sapwood white, heartwood yellowish red-brown.

**37. *Archidendron trifoliolatum* De Wit**, Reinwardtia 2 (1952) 94; Verdc., Manual New Guin. Legum. (1979) 254; Nielsen, Opera Bot. 76 (1984) 84, f. 52, 55. — *Pithecellobium trifoliolatum* (De Wit) Mohlenbr., Webbia 21 (1966) 703, f. 24.



Shrub or small tree up to 6 m high. Branchlets terete, glabrous. Stipules linear, 1–1.5 mm, glabrous, caducous. *Leaves* glabrous all over; rachis 1.5–4.5 cm, eglandular; pinnae 1 pair, 4–6 cm, eglandular; petiolules 2–4 mm; leaflets  $1\frac{1}{2}$  (–2) pairs per pinna, the proximal leaflets usually unpaired, chartaceous, drying grey-brown,  $\pm$  unequal-sided, ovate-oblong, elliptic, or oblanceolate, 6.5–12.5 by 2.2–4.7 cm, base  $\pm$  symmetrically narrowly cuneate, tapering into the petiolule, apex sharply acute-acuminate; principal lateral veins 6–9 per leaflet-half, arching, non-parallel; reticulation prominulous on both surfaces. *Inflorescences* either terminal or borne on the branches below the leaves, with scattered hairs in the distal parts; terminal inflorescences consisting of pedunculate racemes aggregated into a panicle up to 12 by 8 cm, pedicels 2.5–4.5 mm; floral bracts oblong-linear,

scarious, obtuse, c. 1 mm, caducous; lateral inflorescences below the leaves, consisting of peduncled racemes clustered on short-shoots, 2–4.5 cm long. *Male flowers* tri- or tetramerous. Calyx green, subtubular, truncate, 3.5–5 mm, glabrous. Corolla green to creamy-yellow, narrowly funnel-shaped, 9–11 mm, glabrous; lobes ovate, acute, c. 5 mm. *Stamens* white, c. 20 mm, tube equalling the corolla-tube. Ovaries 2, absent or reduced in male flowers. Female flowers, pods and seeds unknown.

Distribution — *Malesia*: Papua New Guinea (Central Prov.).

Habitat & Ecology — Montane forest; altitude 1200–1310 m. Fl. Nov.

Note — Related to the insufficiently known 'sp. C' of Verdcourt (1979: 256) as recorded by Nielsen (l.c.: 84) from Jinju, Rossel Island, Papua New Guinea.

### 3. Series *Stipulatae*

*Archidendron* ser. *Stipulatae* (Mohlenbr.) Nielsen in Nielsen, Baretta-Kuipers & Guinet, Opera Bot. 76 (1984) 85. — *Pithecellobium* sect. *Archidendron* subsect. *Stipulatae* Mohlenbr., Webbia 21 (1966) 671.

Stipules, stipular scars or stipular glands present. *Leaflets* opposite, petiolulate. *Inflorescences* cauliflorous or terminal, consisting of sparsely branched or unbranched flowering racemes (in *Malesia*), or spikes; floral bracts with a ring-shaped nectary near the base. *Flowers* bisexual or male and female. Ovaries solitary or up to 5 (–14), sessile. *Pods* coriaceous or fleshy, contorted or straight, usually constricted between the seeds, or sinuate along the dorsal suture and then usually dehiscing first along this suture. *Seeds* usually imbedded in the segmented pericarp. — **Figs. 16, 17.**

Distribution — About 12 species, in *Malesia* (Moluccas–New Guinea) 11 species, in Australia 1 species.

Habitat & Ecology — Rain forest, generally in the substage. Most species are rare and have been collected only once or twice (cf. Nielsen, l.c.: 87). Therefore, the occurrence of dioecious and polygamous plants is not known in detail. Unisexual flowers and flowers with numerous ovaries are frequent. In male flowers the ovaries are abortive, and often reduced in number.

Morphology & Taxonomy — Extensively reviewed by Nielsen, Baretta-Kuipers & Guinet (l.c.: 5–120). This is the most poorly known series of the genus, much of the type-material of the species being either fragmentary or lost [cf. Verdcourt, Manual New Guin. Legum. (1979) 233; Nielsen, Baretta-Kuipers & Guinet (l.c.: 85)]. Accordingly several species are imperfectly known, incompletely described, and some still remain to be described.

## KEY TO THE SPECIES

(The insufficiently known *40. A. brevicalyx* has not been included)

- 1a. Pinnae 2 or 3 pairs, rachis and pinnae with numerous enlarged and raised lenticels **43. *A. gogolense***
- b. Pinnae 1 pair, rachis and pinnae without lenticels 2
- 2a. Rachis- and pinna-glands with strongly raised margins 3
- b. Rachis- and pinna-glands without raised margins, usually depressed or pit-like 8
- 3a. Leaflets glabrous or subglabrous beneath except perhaps for the patent hairy major veins 4
- b. Leaflets densely pilose beneath, with an indumentum of short, patent hairs 6
- 4a. Inflorescence densely puberulous with patent hairs. Pod short and thick, oblong or ovate, sometimes divided into two short, thick, 1-seeded segments. Glands saucer-shaped **39. *A. brachycarpum***
- b. Inflorescence sparsely to densely puberulous with appressed hairs. Pod curved into a circle or a spiral. Glands not saucer-shaped 5
- 5a. Inflorescence unbranched. Stipules c. 1 mm long, triangular, hard, caducous. Petiolules densely patent puberulous, principal lateral veins of leaflets with a rather dense patent pubescence beneath **46. *A. nervosum***
- b. Inflorescence branched. Stipules 4–8 mm long, filiform or subulate, sometimes rigid and persisting at the older leaves, but usually caducous. Petiolules puberulous; principal lateral veins of leaflets with minute appressed hairs only **48. *A. parviflorum***
- 6a. Rachis- and pinna-glands bowl-shaped **45. *A. molle***
- b. Rachis- and pinna-glands either circular with raised margins or hollow with a narrow orifice 7
- 7a. Pinna-glands circular, 2 mm in diameter, sessile, with raised margins and a flat depressed central part; leaflets 7–17.5 by 2.5–6 cm, ovate-elliptic or oblong-lanceolate, base asymmetrically broadly cuneate. Calyx 1.5–2 mm long, glabrous. Corolla 7 mm long, glabrous. Pod unknown **49. *A. royenii***
- b. Pinna-glands c. 2 mm in diameter, with raised margins and a narrow orifice; leaflets up to 25 by 10–16 cm, broadly ovate or elliptic, base rounded but blade often somewhat decurrent in the petiolule. Calyx 2–4 mm long, puberulous. Corolla 8–10 mm long, puberulous. Pod curved, fleshy or coriaceous, scarlet outside, yellow within, c. 21 by 7–10 cm **44. *A. megaphyllum***
- 8a. Inflorescence pubescent with greenish yellow patent hairs. Lower surface of leaflets faintly puberulous. Stipules unknown **41. *A. brevipes***
- b. Inflorescence glabrous or (densely) puberulous with appressed hairs. Lower surface of leaflets glabrous or faintly puberulous. Stipules persisting, or late caducous, linear-falcate 9
- 9a. Inflorescences terminal. Rachis, pinnae and leaflets below minutely glandular hairy. Calyx 1–1.5 cm long, cupular. Pod contorted **42. *A. glandulosum***
- b. Inflorescences cauliflorous, rarely at the upper leaf-axils. Rachis, pinnae and leaflets below glabrous to puberulous with eglandular hairs. Calyx 2.5–7 mm long, cupular to campanulate 10

- 10a. Base of leaflets  $\pm$  symmetrically cuneate or rounded. Pod curved into a semicircle, 7–17 cm long, 1.5–1.7 cm over the seeds, flattened with a slightly to strongly sinuate dorsal suture, sometimes moniliform due to abortion of some seeds

### 38. *A. aruense*

- b. Base of leaflets symmetrically narrowly cuneate, decurrent in the petiolule. Pod 7–9 cm, basal part stalk-shaped, rugose, 2.5 cm long; upper part cylindrical, c. 3 cm wide, apparently indehiscent . . . . . 47. *A. pachycarpum*

**38. *Archidendron aruense*** (Warb.) De Wit, Bull. Bot. Gard. Buitenzorg 17 (1942) 261; Reinwardtia 2 (1952) 75; Kosterm., Reinwardtia 3 (1954) 24; Verdc., Manual New Guin. Legum. (1979) 230; Nielsen, Opera Bot. 76 (1984) 87, f. 56, 58. — *Hansemannia aruensis* Warb., Bot. Jahrb. 13 (1891) 334. — *Pithecellobium aruense* (Warb.) Mohlenbr., Webbia 21 (1966) 664, f. 3.

? *Archidendron incurvatum* K. Schum. & Lauterb., Fl. Deut. Schutzgeb. Südsee (1900) 344; De Wit, Bull. Bot. Gard. Buitenzorg 17 (1942) 267; Reinwardtia 2 (1952) 85; Verdc., Manual New Guin. Legum. (1979) 241. — *Pithecellobium incurvatum* (K. Schum. & Lauterb.) Mohlenbr., Webbia 21 (1966) 703, f. 23.

*Archidendron racemosum* Pulle, Nova Guinea 8 (1910) 370.

*Archidendron ledermannii* Harms, Bot. Jahrb. 55 (1917) 42; De Wit, Bull. Bot. Gard. Buitenzorg 17 (1942) 268; Reinwardtia 2 (1952) 86.

*Archidendron laxiflorum* Kaneh. & Hatus., Bot. Mag. Tokyo 56 (1942) 355.

*Archidendron* 'sp. I' Verdc., Manual New Guin. Legum. (1979) 259.

Shrub, treelet or small tree to 10 m high. Branchlets terete, minutely puberulous or glabrous. Stipules linear, falcate, acute, (0.8–)2–3.5 cm, minutely puberulous, late caducous. *Leaves*: rachis (8–)15–30 cm, glabrous or minutely puberulous; gland obscure, circular, pit-like, without raised margins, 0.8–2 mm in diameter; pinnae 1 pair, 15–39(–50) cm, glabrous or minutely puberulous; with glands similar to the rachis-gland, 0.5–1 mm in diameter; petiolules 5–7 mm, glabrous or minutely puberulous; leaflets  $2\frac{1}{2}$ – $6\frac{1}{2}$  pairs per pinna, the lower leaflet often unpaired; leaflets opposite, rigidly chartaceous, drying brownish, grey or green,  $\pm$  equal-sided, ovate-elliptic, elliptic, or lanceolate to oblong, 6–25(–30) by 3.1–9.5 cm, base  $\pm$  symmetrically cuneate or rounded, apex acuminate(–caudate), both surfaces glabrous or minutely puberulous, occasionally very minutely glandular haired; principal lateral veins 5–7(–10)

per leaflet-half, arching, non-parallel; reticulation prominulous or prominent above, prominent beneath. *Inflorescences* on the older wood, rarely at the leaf-axils, consisting of unbranched, shortly pedunculate racemes issuing from short-shoots at the axils of old leaf-scars; raceme (1.5–)2.5–10 (–13) cm, glabrous or scarcely puberulous, floral bracts ovate or falcate-filiform, 2–3 mm, pedicels 1.5–5 mm, glabrous. *Flowers* usually pentamerous, male or female, or rarely bisexual. Calyx olivaceous or yellowish green, campanulate, 2.5–6 mm, often with 2 incisions up to 2 mm deep, glabrous; teeth inconspicuous. Corolla creamy white or greenish, funnel-shaped, 13–22 mm, glabrous; lobes ovate-lanceolate to oblong, acute, 4–10 mm. *Stamens* white to light yellow, 30–45 mm, tube shorter than or longer than the corolla-tube. Ovaries 4–8(–14), sessile, glabrous. *Pod* red outside, orange within, curved into a  $\pm$  semicircle, 7–17 by 1.5–2 cm, fleshy, with slightly or strongly sinuous dorsal margin, sometimes moniliform due to abortion of some seeds, glabrous, veins invisible, pod dehiscing first along the dorsal suture. *Seeds* bluish or black, ellipsoid, c. 10–14 by 6–8 by 5–7 mm. — **Figs. 16 A, B, 17 A.**

Distribution — *Malesia*: New Guinea, Aru Is.

Habitat & Ecology — Rain forest, secondary and disturbed forest, regrowth, forest on alluvial flats; altitude 0–600 m. The hollow branches are sometimes inhabited by ants. Fl., fr. throughout the year.

Note — The variation in leaflet-form has been described by Nielsen (l.c.: 87).

**39. *Archidendron brachycarpum*** Harms, Notizbl. Bot. Gart. Berlin 10 (1928) 273; De Wit, Bull. Bot. Gard. Buitenzorg 17 (1942) 263; Reinwardtia 2 (1952) 78; Verdc., Manual New Guin. Legum. (1979) 231; Nielsen, Opera Bot. 76 (1984) 88, f. 56, 57.

*Pithecellobium brevipes* auct. non (K. Schum.) Mohlenbr.: Mohlenbr., Webbia 21 (1966) 713, p.p., quoad syn. *A. brachycarpum* Harms.

? *Archidendron* 'sp. L' Verdc., Manual New Guin. Legum. (1979) 260.



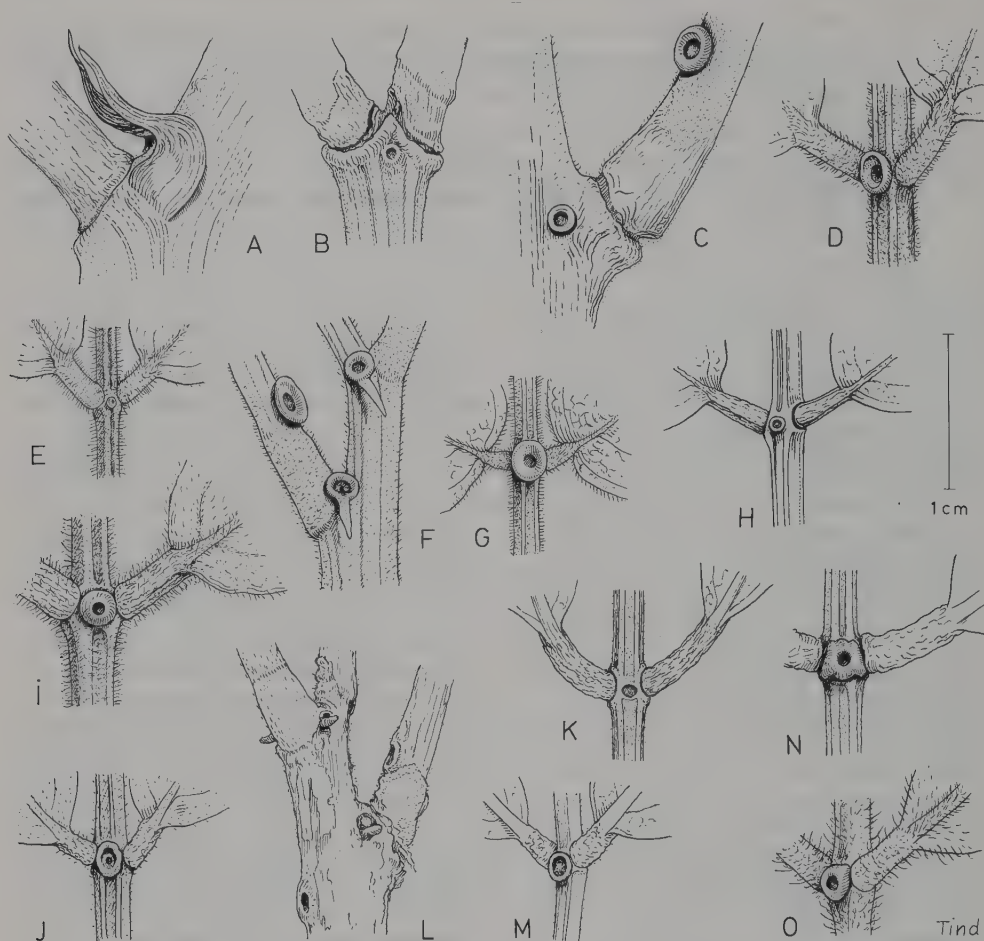


Fig. 16. *Archidendron* ser. *Stipulatae* (Mohlenbr.) Nielsen. Stipules and extrafloral nectaries. — A. *Archidendron aruense* (Warb.) De Wit; stipules; B. rachis gland. — C. *A. brachycarpum* Harms; stipular gland and petiolar gland; D. pinna gland. — E. *A. cf. brevipes*; pinna gland. — F. *A. molle* (K. Schum.) De Wit; stipular glands and petiolar gland; G. rachis gland. — H. *A. glandulosum* Verdc.; pinna gland. — I. *A. nervosum* De Wit; pinna gland. — J. *A. pachycarpum* (Warb.) De Wit; pinna gland. — K. *A. parviflorum* Pulle var. *parviflorum*; leaf-bases and stipules; L. pinna gland. — M. *A. parviflorum* var. *longipes* De Wit; pinna gland. — N. *A. royenii* Kosterm.; pinna gland. — O. *A. megaphyllum* Merr. & Perry; pinna gland (A, B: Pullen 7366; C, D: Lauterbach 456; E: Carr 12766; F, G: NGF 1198; H: NGF 43895; I: de Vogel 3225; J: Warburg 20324; K, L: BW 1251; M: NGF 37428; N: van Royen 5309; O: Schodde 2351).

Small myrmecophilous tree to 5 m high. Branchlets terete, lenticellate, hollow, short-puberulous, probably glabrescent. Stipules absent; stipular glands circular, concave with raised margins, 1–1.5 mm in diameter. Leaves: rachis to 22.5 cm, puberulous by short patent hairs, glands saucer-shaped, with strongly raised margins, sessile, 2.5–3 mm

in diameter, pinnae probably one pair, up to 35 cm, densely short-pubescent, glands similar to rachis-glands, c. 2–2.5 mm in diameter; petioles 5–6 mm, black, patently puberulous; leaflets up to 5 pairs per pinna, opposite, chartaceous,  $\pm$  equal-sided, elliptic-ovate to oblong-lanceolate, 14.5–21 by 8–9 cm, base symmetrically cune-

ate, apex acuminate, both surfaces glabrous except for a few scattered hairs on the major veins; principal lateral veins c. 7 per leaflet-half, arching, non-parallel; reticulation prominulous above and prominent beneath. *Inflorescences* ?dioecious, cauliflorous or supra-axillary in the younger branches, densely pubescent by patent hairs, consisting of unbranched or once-branched racemes, 2–5(–8) cm, with the flowers in the distal parts; floral bracts c. 2 mm, with basal nectary; pedicel up to 3 mm, minutely puberulous. *Flowers* pentamerous, probably bisexual, white. Calyx cup-shaped, 3 mm, minutely puberulous, broadly irregularly lobed to 0.5 mm. Corolla funnel-shaped, (9–)12–13 mm, glabrous; lobes oblong, acute, 4 mm. *Stamens* at least 25 mm, tube equalling the corolla-tube. Ovaries 3, glabrous, surrounded by a tubular nectary. *Pod* (acc. to Harms, l.c.) short and thick, oblong or ovate, 3–6 by 2–4 cm, sometimes divided into two short, thick, 1-seeded segments. Seeds unknown. — **Figs. 16C, D, 17B.**

Distribution — *Malesia*: New Guinea (Gogol Dist.; W Irian: Ransiki), New Ireland, ?New Britain.

Habitat & Ecology — Sandy coastal plains at low altitude. Fr. ?June–July.

Note — Originally based on a specimen from Lamekot, New Ireland. The neotype is from the mouth of the Bumi R., Gogol District. Fruiting specimens with sausage-shaped, wrinkled pods up to 11 by 3 cm and black seeds, 17 by 12 by 7 mm, immersed in the orange fleshy valves of the pods probably belong here. These fruiting specimens were described as 'sp. L' by Verdcourt (l.c.: 260): *NGF 22456* (New Britain), *BW 2294* (Ransiki, W Irian), but flowering material from the same area is needed to decide whether 'sp. L' is conspecific with *A. brachycarpum* (cf. Nielsen, l.c.).

**40. *Archidendron brevicalyx*** Harms, Bot. Jahrb. 55 (1917) 41; De Wit, Bull. Bot. Gard. Buitenzorg 17 (1942) 263; Reinwardtia 2 (1952) 79; Verdc., Manual New Guin. Legum. (1979) 232; Nielsen, Opera Bot. 76 (1984) 88.

*Pithecellobium brevipes* auct. non (K. Schum.) Mohlenbr.: Mohlenbr., Webbia 21 (1966) 713, p.p., quoad cit. syn. *A. brevicalyx* Harms.

Small tree. Branchlets, stipules and stipular glands unknown. *Leaves* with one pair of pinnae, each with 5 or 6 pairs of petiolulate leaflets; petiolules 4–7 mm, leaflets lanceolate-oblong, 13–20 by 5–7 cm; base obliquely obtuse or acute, apex short-acuminate, both surfaces glabrous, lateral veins ascending. *Inflorescences* borne on trunk and branches; short-puberulous, consisting of flower-

ing racemes 3–6 cm; bracts lanceolate, acuminate, 1–3 mm. Calyx short, broadly cup-shaped, 3–4 mm, glabrous or subglabrous, with crenulate margin. Corolla 14–16 mm, glabrous, 5-lobed; lobes deltoid-lanceolate, 6–7 mm or more. *Stamens* 40 mm. Ovary, pod and seeds unknown.

Distribution — *Malesia*: NE Papua New Guinea (Djambu R.).

Habitat — Forest.

Note — No authentic material has been studied. The description is copied from Harms (l.c.).

**41. *Archidendron brevipes*** (K. Schum.) De Wit, Bull. Bot. Gard. Buitenzorg 17 (1942) 263; Reinwardtia 2 (1952) 79, p.p.; Verdc., Manual New Guin. Legum. (1979) 232; Nielsen, Opera Bot. 76 (1984) 88, f. 56, 57. — *Hansemannia brevipes* K. Schum. in K. Schum. & Holtr., Fl. Kais. Wilh. Land (1889) 103; K. Schum. & Lauterb., Fl. Deut. Schutzgeb. Südsee (1900) 343, pl. 9. — *Albizia brevipes* (K. Schum.) F. Muell., Proc. Linn. Soc. N.S.W. ser. 2, 5 (1890) 20. — *Pithecellobium brevipes* (K. Schum.) Mohlenbr., Webbia 21 (1966) 713, f. 13, p.p. [excl. *Archidendron brachycarpum*, *A. brevicalyx*, *A. gawadense*, *A. graciliflorum*, *A. parviflorum* & var. *longipes*, *A. warenense*, and *Hansemannia gawadensis*].

Small slender myrmecophilous tree up to 5 m high. Branchlets and stipules unknown, but stipules apparently caducous. *Leaves*: rachis 20–30 cm, minutely puberulous, gland circular, depressed, without raised margins, c. 2 mm in diameter; pinnae 1 pair, 30–50 cm, appressed puberulous, circular, ± depressed, without raised margins, up to 1 mm in diameter; petiolules black, to 6 mm, puberulous; leaflets 40–60 pairs per pinna, opposite, the lower leaflet unpaired, unequal-sided, ovate-elliptic to oblong-lanceolate, 12–20 by 6–7 cm, base oblique, broadly cuneate or rounded, or half cuneate/half rounded, apex acuminate-caudate, lower surface minutely puberulous especially on the veins, upper surface glabrous or puberulous; principal lateral veins 8 per leaflet-half, arching, non-parallel. *Inflorescence* borne on the trunk, greenish yellow, pubescent by patent hairs, consisting of a simple or once-branched raceme, 1–2.5 cm; floral bracts deflexed, c. 2 mm, with nectary; pedicels 3–5 mm, puberulous or glabrous. *Flowers* male or bisexual. Calyx cup-shaped or campanulate, 3–5 mm, glabrous (in the type) or puberulous, margin crenate or shallowly dentate. Corolla funnel-shaped, (8–)10–15 mm, glabrous, lobes triangular-ovate, acute, 4 mm. *Stamens* 25–





37 mm, tube longer than the corolla-tube. Ovaries 3–5, glabrous. Pod (acc. to K. Schumann, l.c.) c. 30 by 5 cm, with thick margins, dehiscent along both sutures. *Seeds* shining black, obovoid, 4–5 by 2–2.5 cm. — **Figs. 16E, 17C, D.**

Distribution — *Malesia*: NE New Guinea.

Habitat — Forest.

Note — The pod as described by K. Schumann is probably misplaced, and possibly belongs to a species of ser. *Bellae*. For notes on the variation of this species, see Verdcourt (l.c.: 233) and Nielsen (l.c.).

**42. *Archidendron glandulosum*** Verdc., Kew Bull. 32 (1977) 227; Manual New Guin. Legum. (1979) 238; Nielsen, Opera Bot. 76 (1984) 91, f. 58, 59.

Sparsely branched shrub or small tree 1.2–2(–6) m high. Branchlets terete, often hollow, covered by small gland-like hairs. Stipules linear-lanceolate, 2.5–4.7 by 0.2 cm, with glandular hairs and prominent longitudinal veins, persistent. *Leaves*: rachis 12–18 cm, minutely glandular puberulous, gland circular, sessile, without raised margin,  $\pm$  depressed central part, c. 1 mm in diameter; pinnae 1 pair, 13–24 cm, minutely glandular puberulous, glands circular, flat, sessile, without raised margins, 0.5–1 mm in diameter; petiolules black, c. 3 mm, shortly glandular puberulous; leaflets 4 or 5 pairs per pinna, opposite, the lower leaflet sometimes unpaired, chartaceous,  $\pm$  equal-sided, ovate-elliptic, elliptic, or elliptic-oblong, 6–20.5 by 2.3–6.7 cm, base  $\pm$  symmetrically rounded, apex acuminate-caudate; both surfaces subglabrous, with minute glandular hairs especially on midrib and principal veins; principal lateral veins 6–8 per leaflet-half, upwards arching, non-parallel; reticulation prominent above, prominent beneath. *Inflorescence* terminal, minutely glandular hairy, consisting of clustered racemously arranged racemes, the latter up to 7 cm, main axis up to 2 cm; bracts c. 1 mm, with nectary; pedicels 0.5–1 mm, glabrous. *Flowers* pentamerous, bisexual. Calyx pale greenish, cup-shaped, 1–1.5 mm, glabrous, truncate. Corolla

cream, the tips faintly pink, funnel-shaped, 19–20 mm, glabrous; lobes triangular ovate, apiculate, c. 4 mm. *Stamens* cream-white, up to 35 mm, tube slightly shorter than the corolla-tube. Ovary solitary, glabrous. *Pod* orange, densely spirally contorted, 3–6-seeded, segments one-seeded, ovoid, slightly flattened, c. 1–1.5 cm wide, up to 1.4 cm high, constrictions 1–4(–10) mm wide, pod possibly fleshy, veins inconspicuous, dehiscent along both sutures. *Seeds* black, ellipsoid, 1.2 by 7 by 5 mm. — **Figs. 16H, 17E.**

Distribution — *Malesia*: Papua New Guinea (Gulf and Central Provinces).

Habitat & Ecology — Riverine rain forest; altitude 45–600 m. Fl. Mar.

**43. *Archidendron gogolense*** (K. Schum. & Lauterb.) De Wit, Reinwardtia 2 (1952) 84; Bull. Bot. Gard. Buitenzorg 17 (1942) 266, sub *A. pachycarpum*; Mohlenbr., Webbia 21 (1966) 721, sub spec. excl.; Verdc., Manual New Guin. Legum. (1979) 238; Nielsen, Opera Bot. 76 (1984) 93, f. 63, 64. — *Hansemannia gogolensis* K. Schum. & Lauterb., Fl. Deut. Schutzgeb. Südsee (1900) 343.

Tree up to 15 m high. Branchlets and stipules not known. *Leaves*: rachis and pinnae with numerous enlarged and raised lenticels; rachis (27–)c. 48 cm, glabrous, glands circular, concave, with raised margins, c. 3 mm in diameter; pinnae 2 or 3 pairs, c. 33 cm, glabrous, glands similar to the rachis-glands, c. 2 mm in diameter; petiolules 5–6 mm, glabrous; leaflets 4–7 pairs per pinna, opposite, coriaceous, drying chestnut-brown,  $\pm$  unequal-sided, ovate-lanceolate or oblong, 9–17 by 3.2–5.8 cm, base asymmetrically cuneate, apex acute, acuminate, both surfaces glabrous; principal lateral veins c. 6 per leaflet-half,  $\pm$  parallel, arching; reticulation dense, prominent on both surfaces. *Inflorescences* cauliflorous and ramiflorous, glabrous, consisting of once-branched racemes, 8–14 cm, pedicels 2–9 mm; bracts not seen. *Flowers* tri- to pentamerous, male and bisexual. Calyx narrowly campanulate, 5–7 mm, glabrous, margin undulate. Corolla very

Fig. 17. *Archidendron* ser. *Stipulatae* (Mohlenbr.) Nielsen. Inflorescences and flowers. A. *Archidendron aruense* (Warb.) De Wit. — B. *A. brachycarpum* Harms. — C. *A. cf. brevipes*. — D. *A. brevipes* (K. Schum.) De Wit. — E. *A. glandulosum* Verdc. — F. *A. nervosum* De Wit. — G. *A. pachycarpum* (Warb.) De Wit, single flower. — H. *A. parviflorum* Pulle var. *parviflorum*. — I. *A. parviflorum* var. *longipes* De Wit. — J. *A. royenii* Kosterm. (A: Pullen 7366; B: Lauterbach 456; C: Carr 12766; D: Hollrung 763; E: NGF 12876; F: de Vogel 3225; G: Warburg 20324; H: BW 6849; I: NGF 31428; J: van Royen 5309).

narrowly funnel-shaped, 16–23 mm, glabrous, lobes ovate acute, 5 mm. *Stamens* up to 65 mm; tube slightly exceeding the corolla-tube. Ovary solitary, glabrous. Pod and seeds unknown.

*Distribution* – *Malesia*: Papua New Guinea (Madang & West Sepik Provinces).

*Habitat & Ecology* – Rain forest at 30 m altitude.

*Notes* – Only known from 2 collections (Nielsen, l.c.). The characters suggest affinities to ser. *Stipulatae* and ser. *Archidendron*. It is tentatively placed here because of leaf and inflorescence morphology.

Probably 'sp. S' of Verdcourt (l.c.: 264) belongs here too (Nielsen, l.c.).

**44. *Archidendron megaphyllum*** Merr. & Perry, *J. Arnold Arbor.* 23 (1942) 392; De Wit, *Reinwardtia* 2 (1952) 87; Verdc., *Manual New Guin. Legum.* (1979) 244; Nielsen, *Opera Bot.* 76 (1984) 91, f. 59, 60.

*Pithecellobium brassii* Mohlenbr., *Webbia* 21 (1966) 709, f. 27.

Unbranched tree up to 14 m high. Branchlets terete, probably glabrous. Stipules unknown, stipular glands present. *Leaves*: rachis 20–22 cm, patently puberulous, glands not known; pinnae 1 pair, up to 70 cm, densely puberulous by semi-patent hairs, glands circular, suburceolate, with a narrow orifice, margins raised, c. 2 mm in diameter; petiolules 7 mm, dark brown, pilose or hirsute; leaflets 5–7 pairs per pinna, proximal pairs sometimes alternate, chartaceous, drying grey, equal-sided, broadly ovate or elliptic, up to 25 by 10–16 cm, base rounded, often somewhat decurrent into the petiolule, apex obtuse to shortly acuminate, apiculate; upper surface minutely pilose, lower surface densely pilose on the veins; principal lateral veins 7 or 8 per leaflet-half, arching, non-parallel, connected by trabeculate anastomoses; reticulation inconspicuous above, raised beneath. *Inflorescence* below the leaves, raceme-like, simple, 3–6 cm. Calyx 2–4 mm, puberulous. Corolla 8–10 mm, puberulous. Stamens and ovaries not known. *Pod* scarlet outside, yellow within, curved, valves twisted after dehiscence, c. 7–10 by 2 cm, fleshy-coriaceous, glabrous, veins inconspicuous, dehiscing first along the dorsal suture. *Seeds* black, oblong, up to 15 by 10 mm. – **Fig. 16 O.**

*Distribution* – *Malesia*: Papua New Guinea (Southern & Western Highlands Provinces), ? W Irian (Mt Carstensz).

*Habitat & Ecology* – Rain forest; altitude 100–800 m.

*Note* – For notes on variation, see Nielsen (l.c.).

**45. *Archidendron molle*** (K. Schum.) De Wit, *Bull. Bot. Gard. Buitenzorg* 17 (1942) 269; Reinwardtia 2 (1952) 88; Verdc., *Manual New Guin. Legum.* (1979) 244; Nielsen, *Opera Bot.* 76 (1984) 91, f. 59, 60. — *Hansemannia mollis* K. Schum., *Bot. Jahrb.* 9 (1888) 202; K. Schum. & Hollr., *Fl. Kais. Wilh. Land* (1889) 103. — *Albizia mollis* (K. Schum.) F. Muell., *Proc. Linn. Soc. N.S.W.* ser. 2, 5 (1890) 20, non Boiv. (1838). — *Archidendron mollis* (K. Schum.) Kaneh. & Hatus., *Bot. Mag. Tokyo* 56 (1942) 357, non (K. Schum.) De Wit (1942). — *Pithecellobium molle* (K. Schum.) Mohlenbr., *Webbia* 21 (1966) 706, f. 26.

Tree up to 32 m high, bole up to 18 m high, d.b.h. 20–35 cm. Branchlets terete, ferrugineously puberulous or pilose, hollow. Stipules gland-like, sometimes with a downwards-pointed acumen. *Leaves*: rachis (2–)12–20 cm, pilose, glands raised, bowl-shaped, 2–4 mm in diameter, margin sharply rimmed, ciliate; pinnae 1 pair, (6–)16–35 cm, densely pilose by patent hairs, glands similar to the rachis-glands but smaller; petiolules 1–3 mm, strongly hirsute; leaflets (2–)4–6(–8) pairs per pinna, opposite, basal leaflet sometimes unpaired, equal-sided, ovate-elliptic, elliptic, or oblong, (5–)10–18 by (2.5–)4–10 cm, base rounded to broadly cuneate, apex acuminate, both surfaces softly ferrugineously pubescent; principal lateral veins 5 or 6 per leaflet-half, oblique, strongly raised, parallel; reticulation prominulous above, prominent beneath. *Inflorescence* borne on the trunk, puberulous or tomentellous, consisting of a branched and slender raceme, up to 3 cm long, pedicels 1.5–4(–6) mm, glabrous or puberulous. *Flowers* pentamerous, male and female, yellowish or white. Calyx narrowly cup-shaped, 3 mm, glabrous or puberulous, toothed or indented in two places. Corolla funnel-shaped, 8–12(–17) mm, ± glabrous; lobes oblong, acute, 3–5 mm. *Stamens* 22–35 mm. Ovaries usually 5, much reduced in male flowers. Pod and seeds unknown. – **Fig. 16 F, G.**

*Distribution* – *Malesia*: New Guinea (W Irian and NE Papua New Guinea).

*Habitat & Ecology* – Forest at low altitudes.

*Field notes* – Sometimes recorded with buttresses up to 1.4 m high. Bark greyish or brown, sometimes shallowly fissured, inner bark green or brown, blaze creamish with numerous fine, longitudinal, pinkish or purplish lines. Wood whitish with yellow-brown bands and an unpleasant odour; sapwood not defined or recorded as light brown; heartwood brown.

*Note* – For notes on variation see Nielsen (l.c.). Closely related to *A. brevipes* and *A. royenii*, but glands and venation different.

**46. *Archidendron nervosum*** De Wit, Reinwardtia 2 (1952) 89; Nielsen, Opera Bot. 76 (1984) 91, f. 61, 62. — *Pithecellobium kos-termansianum* Mohlenbr., Webbia 21 (1966) 718.

Tree to 15 m high; bole 5 m high, to 14 cm in diameter. Branchlets terete, hollow, myrmecophilous, patently puberulous, glabrescent. Stipules triangular, coriaceous, c. 1 mm, caducous, stipular glands present. *Leaves*: rachis 11–15 cm, patently puberulous, glands sessile, circular or transversely elliptic, with raised margins, 1.5–2 mm in diameter; pinnae 1 pair, 15–30 cm, patently puberulous, glands similar to rachis glands; petiolules black, 2–4 mm, densely patently puberulous; leaflets 2–5 pairs per pinna, opposite, lower, and with a unpaired leaflet, chartaceous, equal-sided, ovate, elliptic, or obovate-elliptic, 7–16 by 4.8–8.7 cm, base broadly cuneate or asymmetrically rounded, apex shortly acuminate, both surfaces glabrous major veins beneath densely patent-pubescent; principal lateral veins 5–7 per leaflet-half, prominent, parallel, arching; reticulation dense, prominent. *Inflorescences* clustered on the trunk or supra-axillary at the leaves, minutely to densely puberulous, consisting of unbranched racemes, 1–4 cm, floral bracts linear, c. 2 mm, pedicels 4–8 mm, glabrous. *Flowers* pentamerous, male. Calyx cupular, 4–6 mm, glabrous, teeth rounded, up to 1 mm. Corolla broadly tubular, 15–17 mm, glabrous; lobes ovate-elliptic, acute, 5 mm. *Stamens* 35 mm, tube equalling the corolla; disc-like nectary present. Ovaries unknown. Pod and seeds unknown. — **Figs. 16 I, 17 F.**

Distribution — *Malesia*: Aru Islands (Wokam), N Moluccas (Halmahera).

Habitat & Ecology — Primary rain forest; altitude 70 m.

Field notes — Buttresses few, c. 0.3 by 0.3 m. Bark grey, smooth, warted by lenticels; the inner bark reddish yellow. Sapwood yellow with darker rings.

Note — Related to *A. parviflorum* but differing in indumentum, by the shape of the inflorescences, and by larger flowers.

**47. *Archidendron pachycarpum*** (Warb.) De Wit, Bull. Bot. Gard. Buitenzorg 17 (1942) 269; Reinwardtia 2 (1952) 91; Verdc., Manual New Guin. Legum. (1979) 247; Nielsen, Opera Bot. 76 (1984) 92, f. 60, 61. — *Hansemannia pachycarpa* Warb., Bot. Jahrb. 13 (1891) 333. — *Pithecellobium pachycarpum* (Warb.) Mohlenbr., Webbia 21 (1966) 668.

Habit and branches unknown. Stipules (acc. to Warburg, l.c.) lanceolate-falcate, 1 cm, persisting. *Leaves*: rachis c. 25 cm, glabrous, gland circular, sunken, without raised margins, c. 1 mm in diameter; pinnae 1 pair, 21.5 cm, minutely puberulous, glands similar to rachis-gland; petiolules black, 5–6 mm, minutely puberulous; leaflets 3 or 4 pairs per pinna (the lower leaflet sometimes unpaired), opposite, chartaceous, equal-sided, oblanceolate, 13–18 by 5–8 cm, base symmetrically narrow-cuneate, decurrent into the petiolule, apex rather abruptly acuminate, both surfaces glabrous; principal lateral veins c. 7 per leaflet-half, arching, non-parallel; reticulation prominulous above, prominent beneath. *Inflorescences* probably cauliflorous, consisting of racemes c. 2 cm long (acc. to Warburg, l.c.), indumentum and bracts unknown; pedicel 2 mm, glabrous. *Flowers* pentamerous, male. Calyx cup-shaped, 5–7 mm, glabrous, shallowly dentate. Corolla broadly campanulate, c. 18 mm, glabrous; lobes oblong-lanceolate, acute, c. 8 mm. *Stamens* 40–50 mm; tube about equalling the corolla-tube. Reduced ovaries 3–6, glabrous. *Pod* 7–9 cm long, basal part stalk-shaped, 2.5 cm, rugose; distal part c. 3 cm wide, apparently not dehiscent, with 5 oblong, glossy, brown seeds separated by c. 5 mm wide necks. — **Figs. 16 J, 17 G.**

Distribution — *Malesia*: NE Papua New Guinea (Constantinhafen).

Habitat & Ecology — Coastal forest; altitude 0–40 m.

Note — Only known from the fragmentary lectotype. Probably allied to *A. aruense* (Nielsen, l.c.).

**48. *Archidendron parviflorum*** Pulle, Nova Guinea 8 (1910) 369; De Wit, Bull. Bot. Gard. Buitenzorg 17 (1942) 270; Reinwardtia 2 (1952) 91; Verdc., Manual New Guin. Legum. (1979) 247; Nielsen, Opera Bot. 76 (1984) 92, f. 61, 62. ? *Archidendron graciliflorum* Harms, Bot. Jahrb. 55 (1917) 42; De Wit, Bull. Bot. Gard. Buitenzorg 17 (1942) 266.

*Hansemannia gawadensis* Baker f., J. Bot. 61 (1923) Suppl. 13. — *Archidendron gawadense* (Baker f.) De Wit, Bull. Bot. Gard. Buitenzorg 17 (1942) 266; Merr. & Perry, J. Arnold Arbor. 23 (1942) 392.

*Archidendron warenense* Kaneh. & Hatus., Bot. Mag. Tokyo 56 (1942) 359.

*Pithecellobium brevipes* auct. non (K. Schum.) Mohlenbr.: Mohlenbr., Webbia 21 (1966) 713, p.p., quoad syn. *Archidendron gawadense*, *A. graciliflorum*, *A. parviflorum*, *A. warenense*, and *Hansemannia gawadensis*.



Distribution – *Malesia*: New Guinea.  
Habitat & Ecology – See the varieties.

#### KEY TO THE VARIETIES

- 1a. Leaflets 5.1–20 by 2.2–10 cm. Lateral branches of inflorescence up to 1.8 cm; pedicels 2–7 mm . . . . . **a. var. *parviflorum***
- b. Leaflets 9.5–30 by 5.5–15 cm. Lateral branches of inflorescence up to 3.5 cm; pedicels 5–14 mm . . . . . **b. var. *longipes***

#### **a. var. *parviflorum***

Tree up to 30 m high, bole up to 14 m high, up to 50 cm in diameter. Branchlets terete in the younger parts, covered by pale minute glandular hairs, glabrescent; distal part of branchlet often covered with small prickles formed by bract-like nectaries. Stipules filiform or subulate, 4–8 mm, sometimes rigid and persisting, but usually caducous; stipular glands similar to the foliar glands, often present at the leaf-scars. *Leaves*: rachis 6–30 cm, densely short-puberulous, glands (sub)circular, 2–3 mm in diameter, sessile, margins thick, raised, central part depressed; pinnae 1 pair, 9–40 cm, densely short-puberulous, with glands similar to the rachis-glands, 1.5–2 mm in diameter; petioles black, 2–4 mm, puberulous; leaflets 4–6 pairs per pinna (the lower leaflet sometimes unpaired), opposite, chartaceous, drying brownish,  $\pm$  unequal-sided, ovate-elliptic, elliptic, or elliptic-oblong, 5.1–20 by 2.2–10 cm, base  $\pm$  symmetrically cuneate, sometimes attenuate or rounded, apex acuminate, acute, both surfaces glabrous except for minutely puberulous major veins; principal lateral veins 5 or 6 per leaflet-half, arching; reticulation delicate, prominulous above, prominent beneath. *Inflorescences* cauliflorous, ramiflorous, or supra-axillary at the terminal leaves; shortly puberulous, consisting of simple or once-branched racemes, 1–8.5 cm; floral bracts c. 3 mm, with nectary; pedicels 2–7 mm, very shortly glandular puberulous to glabrous. *Flowers* pentamerous, male or bisexual. Calyx light green, cupular, 1.5–3 mm, glabrous; teeth deltoid, c. 2 mm. Corolla greenish white or white, funnel-shaped, 5.5–9 mm, glabrous; lobes ovate or ovate-oblong, acute, 2.5–3 mm. *Stamens* white, c. 20 mm; tube equalling the corolla-tube. *Ovaries* 2–5, glabrous. *Pod* red, curved into a semi- or a full circle, slightly flattened, c. 10–13 by 1.3 cm,  $\pm$  indented along the dorsal suture, with necks between the seeds, probably fleshy, wrinkled when dry, glabrous, with inconspicuous veins, dehiscing along the dorsal suture.

*Seeds* black, ellipsoid, 7–10 by 4–6 mm. – **Figs. 16 K, L, 17 H.**

Distribution – *Malesia*: W Irian and W part of Papua New Guinea.

Habitat & Ecology – Primary rain forest of flat country; also in swampy places; altitude up to 100 m.

Field notes – Outer bark light brown, smooth; inner bark white; slash yellow; sapwood yellow to white.

Note – Most specimens seen are sterile. Close to *A. nervosum*.

- b. var. *longipes*** De Wit, Reinwardtia 2 (1952) 92; Verdc., Manual New Guin. Legum. (1979) 248; Nielsen, Opera Bot. 76 (1984) 92, f. 61, 62.

Slender tree up to 8 m high, bole up to 5 m, d.b.h. 5–10 cm. *Leaves*: rachis to 30 cm, glabrous or very minutely puberulous distally, glands  $\pm$  quadrangular in outline, sessile, bordered by a thick rim, up to 3 mm in diameter; pinnae 1 pair, up to 60 cm, minutely puberulous, with glands similar to the rachis-glands, c. 2 mm; leaflets  $5\frac{1}{2}$ – $6\frac{1}{2}$  pairs per pinna, subcoriaceous,  $\pm$  equal-sided, (ovate-)elliptic, 9.5–30 by 5.5–15 cm, base  $\pm$  symmetrically broadly cuneate, somewhat tapering, apex obtuse or shortly acuminate. *Inflorescences* cauliflorous or supra-axillary, minutely puberulous or glabrous, consisting of once-branched racemes, 3–10 cm, lateral branches to 3.5 cm; pedicels 5–14 mm. Calyx campanulate, 2.5–4 mm; teeth obtuse, c. 0.3 mm. Corolla funnel-shaped, c. 9 mm; lobes oblong, acute, 4–5 mm. *Stamens* c. 15 mm; tube equalling the corolla-tube. *Ovaries* 4 or 5, glabrous. *Pod* bright orange-red or red outside, yellow or orange inside, curved into a circle or a spiral, 8.5–14 by 1.4–2 cm, slightly to deeply (halfway) lobed along the dorsal suture, fleshy, glabrous, with inconspicuous veins, dehiscing along the dorsal suture. *Seeds* black, ellipsoid or obovoid-ellipsoid, 14–16 by 5–10 mm. – **Figs. 16 M, 17 I.**

Distribution – *Malesia*: Papua New Guinea (Morobe Prov.).

Habitat & Ecology – Rain forest, secondary roadside vegetation; altitude 45–800(–1140) m. Fl. Aug.; fr. Feb., July.

Field notes – Outer bark brown or grey-brown with conspicuous horizontal lenticels; inner bark straw; wood white; trunk hollow throughout, wood and bark with a disagreeable odour.

Note – Specimens recorded as 'sp. M3' by Verdcourt (l.c.: 262) probably belong here (Nielsen, l.c.).

49. *Archidendron royenii* Kosterm., *Adansonia sér.* 2, 6 (3) (1966) 371, pl. 6; Verdc., *Manual New Guin. Legum.* (1979) 251; Nielsen, *Opera Bot.* 76 (1984) 93, f. 58, 61.

Small tree c. 5 m high, 33 cm in diameter. Branchlets, stipules and petiole not known. Pinnae probably 1 pair, 28–40 cm, rusty hispidulous; glands circular, sessile, puberulous, with raised margins and a flat depressed central part, c. 2 mm in diameter; petiolules 3–4 mm, rusty hirsute; leaflets 5 pairs per pinna (with a single unpaired lower leaflet), opposite, chartaceous, unequal-sided, ovate-elliptic or oblong-lanceolate, 7–17.5 by 2.5–6 cm, base asymmetrically broadly cuneate or half cuneate/half rounded, apex acuminate-caudate; both surfaces with a lax indumentum of short patent

hairs; principal lateral veins 5–7 per leaflet-half, arching, non-parallel; reticulation prominulous on both surfaces. *Inflorescences* cauliflorous, scarcely glandular hairy, consisting of once-branched racemes, 1.5–4.5 cm; floral bracts with nectary; pedicel to 6 mm, glandular hairy. *Flowers* pentamerous, female, white with a greenish tinge. Calyx cup-shaped or campanulate, 1.5–2 mm, glabrous; teeth blunt, 0.2 mm. Corolla narrowly funnel-shaped, 7 mm, glabrous, lobes triangular-ovate, acute, 2–3 mm. *Stamens* c. 15 mm; tube equaling the corolla-tube. Ovaries 4, glabrous. Pod and seeds unknown. – **Figs. 16 N, 17 J.**

Distribution – *Malesia*: West Irian (Waigeo Is.).

Habitat & Ecology – Primary lowland rain forest; altitude up to 100 m. Bark olive-brown. Fl. Jan.

4. Series Calycinae

*Archidendron* ser. *Calycinae* Nielsen in Nielsen, Baretta-Kuipers & Guinet, *Opera Bot.* 76 (1984) 95.

*Pithecellobium* sect. *Archidendron* subsect. *Alatae* Mohlenbr., *Webbia* 21 (1966) 663, p.p., excl. *P. hispidum* Mohlenbr.

Stipules or stipular scars not seen, probably absent. Petiole unwinged (pinnae winged in one species); pinnae plurifoliolate; leaflets opposite, sessile, articulated into round pits similar to the pinna-glands. *Inflorescences* erect, cauliflorous, consisting of simple racemes or slightly branched panicles; floral bracts with nectary or not. *Flowers* male and bisexual. Calyx inflated at least at the mouth, strongly ribbed, membranous. Ovaries (1–) 2–4 per flower, sessile. *Pod* (poorly known) fleshy or coriaceous, densely contorted, flattened, only slightly sinuate along the dorsal suture, dehiscing along the dorsal suture.

Distribution — *Malesia*: 3 closely related species endemic to New Guinea.

Morphology — Extensively reviewed by Nielsen, Baretta-Kuipers & Guinet (l.c.: 5–120).

KEY TO THE SPECIES

- 1a. Pinnae with two narrow wings in the distal part, wings 0.5–2 mm wide. Calyx c. 12 mm long, narrowly campanulate, inflated at the mouth . . . . . 50. *A. alatum*
- b. Pinnae unwinged . . . . . 2
- 2a. Glands bowl-shaped. Principal lateral veins 4 or 5 per leaflet-half, very oblique. Inflorescence consisting of short unbranched racemes. Calyx 20–32 mm long, narrowly campanulate, inflated . . . . . 51. *A. calycinum*
- b. Glands circular or subcircular with strongly raised, thick margins. Principal lateral veins 6–9 per leaflet-half, slightly oblique. Inflorescence consisting of a short, sturdy panicle, branched from the base. Calyx 8–20 mm long, tubular, but in the female specimens inflated at the mouth . . . . . 52. *A. sessile*

**50. *Archidendron alatum*** Pulle ex De Wit, Webbia 9 (1954) 458; Verdc., Manual New Guin. Legum. (1979) 229; Nielsen, Opera Bot. 76 (1984) 95. — *Pithecellobium alatum* (Pulle ex De Wit) Mohlenbr., Webbia 21 (1966) 663, f. 1.

Shrub to 4 m high. Branchlets terete, glabrous. *Leaves*: rachis 18–25 cm, glabrous, glands bowl-shaped, with a distinct cavity, 3–4 mm in diameter; pinnae 2 or 3 pairs, 6–13 cm, sharply ribbed and with two narrow, 0.5–2 mm wide wings in the distal part, glabrous, glands bowl-shaped, c. 2 mm in diameter; leaflets 2–4 pairs per pinna, opposite, chartaceous, drying light green, unequal-sided, obovate-elliptic to lanceolate, 8.5–14.5 by 3.3–5 cm, base  $\pm$  symmetrical, broadly cuneate to rounded, apex strongly acuminate; both surfaces glabrous, except for the main vein; principal lateral veins 8–11 per leaflet-half, arching, reticulation very dense, delicate on both surfaces. *Inflorescences* cauliflorous, glabrous, consisting of unbranched racemes c. 1 cm long, floral bracts eglandular, 1.5–2 mm, pedicels 4–6 mm, glabrous, striate. *Flowers* tetramerous, bisexual, green. Calyx narrowly campanulate, inflated at the mouth, c. 12 mm, glabrous; teeth irregular, broadly acute to obtuse, c. 2–3 mm. Corolla narrowly funnel-shaped, 25–35 mm, glabrous; lobes narrowly oblong, acute, 10 mm. *Stamens* white, 50–60 mm, tube not seen. Ovaries 2 or 3, glabrous. Pod and seeds unknown.

Distribution – *Malesia*: West Irian (Beaufort R.).

Habitat & Ecology – Primary rain forest near river bank; altitude 80 m. Fl. Nov.

Note – Only known from the type collection (*Pulle* 383, iso BO, L).

**51. *Archidendron calycinum*** Pulle, Nova Guinea 8 (1910) 370, t. 68; De Wit, Bull. Bot. Gard. Buitenzorg 17 (1942) 264; Reinwardtia 2 (1952) 81; Verdc., Manual New Guin. Legum. (1979) 234; Nielsen, Opera Bot. 76 (1984) 95, f. 65, 66. — *Pithecellobium calycinum* (Pulle) Mohlenbr., Webbia 21 (1966) 680, f. 10.

Single-stemmed shrub or small tree with terminal crown, up to 5 m high. Branchlets and stipules not seen. *Leaves*: rachis up to 50 cm, minutely puberulous, glands bowl-shaped, with strongly raised margins, 3–5 mm in diameter; pinnae 1–4 pairs, 15–50 cm, minutely puberulous, glands bowl-shaped, c. 3 mm in diameter; leaflets 2–5 pairs per pinna, chartaceous, drying bright green or pale yellowish green,  $\pm$  equal-sided, ovate-elliptic

or elliptic, (8–)13–22 by 5.5–13 cm, base broadly cuneate, apex narrowly acuminate, both surfaces glabrous except for the minutely puberulous major veins; principal lateral veins 4 or 5 per leaflet-half, very oblique, arching, reticulation delicate on both surfaces. *Inflorescences* cauliflorous, glabrous, consisting of densely clustered unbranched racemes, 3–6 cm; floral bracts eglandular, linear, glabrous, c. 7 mm; pedicels 3–7 mm. *Flowers* pentamerous, bisexual. Calyx pale green, narrowly campanulate, inflated, strongly net-veined, 20–32 mm, glabrous, lobes irregular, triangular, c. 17 mm. Corolla greenish brown, campanulate, (23–)35 mm, glabrous; lobes oblong, acute, c. 17 mm. *Stamens* c. 50 mm; tube shorter than the corolla. Ovaries 3 or 4, glabrous. Pod and seeds not known.

Distribution — *Malesia*: New Guinea (? Digul & Gulf Prov.).

Habitat & Ecology – Hill-forest; altitude 420–800 m. Fl. Sep.

**52. *Archidendron sessile*** (Scheffer) De Wit, Bull. Bot. Gard. Buitenzorg 17 (1942) 270; Reinwardtia 2 (1952) 93; Verdc., Manual New Guin. Legum. (1979) 252; Nielsen, Opera Bot. 76 (1984) 95, f. 65, 66. — *Pithecellobium sessile* Scheffer, Ann. Jard. Bot. Buitenzorg 1 (1876) 22; Harms, Bot. Jahrb. 55 (1917) 39; Mohlenbr., Webbia 21 (1966) 679, f. 9. — *Albizia sessilis* (Scheffer) F. Muell., Descr. Not. Papuan Pl. 1 (1876) 24.

*Archidendron vandersijdei* Mohlenbr. ex Verdc., Kew Bull. 33 (1978) 125; Manual New Guin. Legum. (1979) 254.

Treelet c. 2.5 m high. Branchlets terete, glabrous. Stipules not seen. *Leaves*: rachis 38–50 cm, puberulous-glabrous, glands circular or subcircular, with strongly raised thick margins, c. 3–4 m in diameter; pinnae 3 pairs, 15–55 cm, puberulous or glabrous, glands circular or rhombic in outline, with thick and raised margins, 2–3 mm in diameter; leaflets 2–4 pairs per pinna, chartaceous, drying pale yellow-green,  $\pm$  equal-sided, ovate-elliptic or elliptic-lanceolate, 6.5–25 by 4.5–9(–12) cm, base symmetrically cuneate, apex obtusely acuminate, both surfaces glabrous; principal lateral veins 6–9 per leaflet-half, arching, not very oblique, reticulation dense, prominulous above, prominent beneath. *Inflorescences* ramiflorous, glabrous, consisting of a short, sturdy branched panicle up to 1.5 cm, floral bracts linear, scarious, c. 2 mm, occasionally with a nectary, caducous; pedicels 2–3 mm. *Flowers* pentamerous, male or female. *Male flower*: calyx tubular, densely striate, 8 mm, gla-



brous or slightly puberulous, teeth triangular-ovate, acute, c. 2 mm; corolla tubular, 20 mm, glabrous, lobes linear, acute, c. 10 mm; stamens 33 mm; ovary solitary, glabrous. *Female flower*: calyx 14–20 mm, widened at the mouth; corolla 21–25 mm; ovaries 2, glabrous. *Pod* red, densely contorted, flattened, c. 10 by 1.7 cm, slightly sin-

uate along the dorsal suture, hard-fleshy, glabrous, valves with visible veins, mode of dehiscence unknown. Seeds unknown.

*Distribution* — *Malesia*: West Irian (Vogelkop, Jayapura Prov., Mimika/Digul).

*Habitat & Ecology* — Primary rain forest on sloping ground; soil sandy-clayey; altitude c. 100 m.

### 5. Series *Ptenopae*

*Archidendron* ser. *Ptenopae* Nielsen in Nielsen, Baretta-Kuipers & Guinet, *Opera Bot.* 76 (1984) 96.

Stipules present, caducous. Leaf-rachis and pinnae strongly 2-winged; pinnae pluri-foliolate, leaflets opposite, not articulated in round pits similar to the pinna-glands. *Inflorescences* (only known in one species) terminal, consisting of pedunculate umbels; floral bracts eglandular. *Flowers* bisexual. Calyx neither inflated nor strongly ribbed. Ovaries 2–15 per flower, sessile. *Pod* contorted or curved into a circle, slightly constricted between the seeds along the dorsal suture, surface muricate and wrinkled, probably woody-coriaceous, dehiscing along both sutures.

*Distribution* — *Malesia*: 2 species, endemic to New Guinea.

#### KEY TO THE SPECIES

- 1a. Branchlets not tuberculate, glabrous; petiole and pinnae glabrous, leaflets ovate-elliptic or elliptic-oblong, 6.3–18 by 3.7–8.5 cm . . . . . **54. *A. ptenopum***
- b. Branchlets tuberculate, bristly rusty setose; petiole and pinnae bristly rusty setose, leaflets oblong-lanceolate, 14.5–24(–30) by 5–6.5(–9.5) cm . **53. *A. hispidum***

**53. *Archidendron hispidum*** (Mohlenbr.) Verdc., *Kew Bull.* 32 (1977) 230; *Manual New Guin. Legum.* (1979) 240; Nielsen, *Opera Bot.* 76 (1984) 96, f. 65, 66. — *Pithecellobium hispidum* Mohlenbr., *Webbia* 21 (1966) 664, f. 2.

Shrub or small tree up to 4 m high, stem to 7 cm in diameter. Branchlets terete, tuberculate, bristly rusty pubescent. Stipules subulate-setaceous, 0.7–2 cm, bristly pubescent. *Leaves*: rachis 19–25 cm, bristly rusty setose, wings 0.2–1.2 cm wide, glands raised, circular,  $\pm$  concave, c. 1 mm in diameter; pinnae 1 pair, 19–25 cm, bristly rusty setose, wings 0.2–1.2 cm wide, glands similar to rachis-glands; leaflets  $3\frac{1}{2}$  pairs per pinna, subsessile, chartaceous, drying grey to brown,  $\pm$  unequal-sided, oblong-lanceolate, 14.5–24(–30) by 5–6.5(–9.5) cm, base asymmetrically rounded to

subcordate, apex acuminate-caudate, upper surface glabrous, lower surface with scattered bristly hairs on the major veins; principal lateral veins 8–10 per leaflet-half, oblique; reticulation dense, prominent above, raised beneath. *Inflorescence* and *flowers* unknown. *Infructescence* cauliflorous and possibly also terminal, with remnants of pedicellate flowers. *Pod* red, curved into a circle or spirally contorted, up to c. 15 by 1.2–1.4 cm, coriaceous, constricted between the seeds, dehiscing along the dorsal suture, glabrous or with scattered bristly hairs, rugose, veins inconspicuous. *Seeds* black, ellipsoid, slightly compressed, c. 10 by 7 mm.

*Distribution* — *Malesia*: Papua New Guinea (Northern & Milne Bay Prov.).

*Habitat & Ecology* — Lowland rain forest on flatlands; fairly tall and open secondary forest; altitude c. 350 m. Fr. Sep.

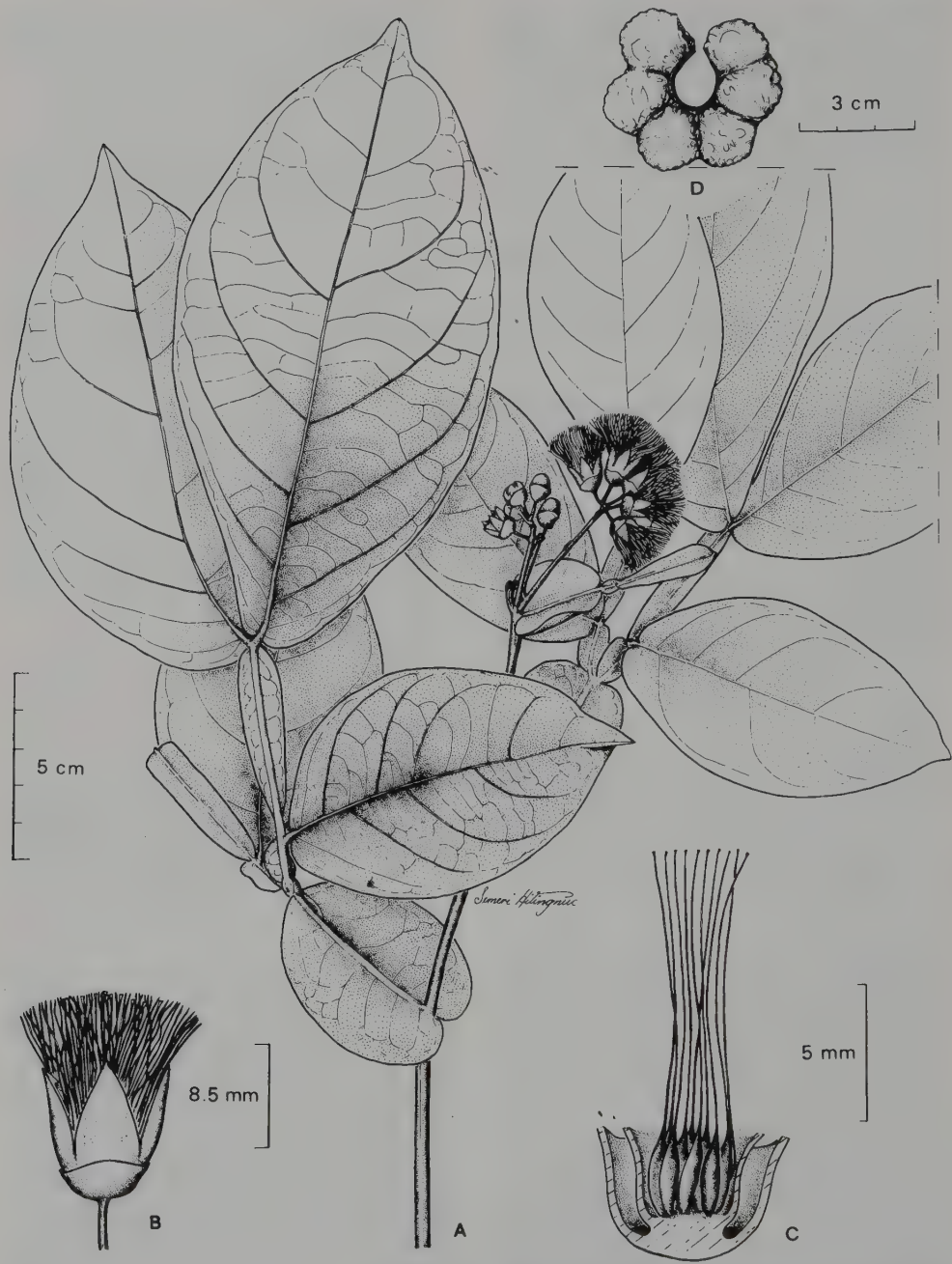


Fig. 18. *Archidendron ptenopum* Verdc. A. flowering branch; B. flower; C. section showing ovaries, stamens and most of perianth removed; D. part of pod (A–C: NGF 25011; D: NGF 44212). By courtesy of Kew Bulletin, Roy. Bot. Gardens, Kew.

Field notes — Bark grey-green with large pustular lenticels and longitudinal fissures with cork bands along them; underbark white, inner straw; wood straw.

**54. *Archidendron ptenopum*** Verdc., Kew Bull.

32 (1977) 225, f. 1; Manual New Guin. Legum. (1979) 249, f. 60; Nielsen, Opera Bot. 76 (1984) 96, f. 66.

Tree 9–13.5 m high, bole up to 10.5 m high, d.b.h. up to 40 cm. Branchlets terete, slightly angular in the distal parts, glabrous. Stipules linear-filiform, acute, c. 7 mm, caducous. *Leaves*: rachis 3–5 cm, conspicuously winged, wings 3–6 cm, wide, glabrous, gland raised, cylindrical, flat, c. 1 mm in diameter; pinnae 1 pair, 5–17 cm, wings up to 1.4 cm wide, glands  $\pm$  raised, domed, cylindrical, c. 0.5 mm in diameter; leaflets 1–3 pairs per pinna, sessile, opposite, chartaceous, drying brown, unequal-sided, ovate, ovate-elliptic, or oblong-elliptic, 6.3–18 by 3.7–8.5 cm, base obliquely subcordate, apex shortly bluntly acuminate, both surfaces glabrous principal lateral veins 5 or 6 per leaflet-half, rather oblique; reticulation incon-

spicuous above, prominent beneath. *Inflorescences* terminal, glabrous, consisting of simple or once-branched pedunculate umbels or corymbs; corymbs or umbels consisting of up to 10 flowers, pedicels 4–5 mm, glabrous, floral bracts not seen. *Flowers* pentamerous, bisexual. Calyx green, cup-shaped, truncate, 3 mm, glabrous. Corolla greenish cream, subcampanulate, 9–12.5 mm, golden sericeous especially on the lobes; lobes triangular-ovate or ovate-lanceolate, acute, 5–7 mm. *Stamens* white, 15–17 mm, tube equalling the corolla-tube. Ovaries c. 15, sessile, glabrous. *Pod* not completely known, reddish, curved into a circle, only slightly sinuate along the dorsal suture, woody, rugulose outside, glabrous, mode of dehiscence not known, seeds in separate compartments, segments 1.5 by 1.8 cm. Seeds not known. — **Fig. 18.**

Distribution — *Malesia*: Papua New Guinea (Morobe Prov.).

Habitat & Ecology — Rain forest; altitude c. 180 m. Fl. Oct.

Field notes — Bark whitish or mottled silvery brown-green, with raised brown lenticels, blaze light reddish brown; wood hard and heavy, yellowish white with brown streaks.

## 6. Series *Morolobiae*

*Archidendron* ser. *Morolobiae* (Kosterm.) Nielsen in Nielsen, Baretta-Kuipers & Guinet, Opera Bot. 76 (1984) 96. — *Morolobium* Kosterm., Bull. Organ. Natuurw. Onderz. Indon. 20 (1954) 11.

Stipules usually present in juvenile branches. Leaf-rachis and pinnae unwinged; pinnae unifoliolate (in *Malesia*) or if with more leaflets, then only the distal pair opposite; leaflets petiolulate, not articulated in pits similar to the pinna-glands. *Inflorescences* possibly pendulous, ramiflorous, axillary at the distal leaves or terminal, consisting of racemously arranged pedunculate glomerules; floral bracts eglandular. *Flowers* bisexual. Calyx neither inflated nor ribbed. Ovary solitary, sessile. *Pod* (not known from *Malesian* species) curved, twisted after dehiscence, fleshy, sinuate along the dorsal suture, dehiscing either along the ventral or the dorsal suture.

Distribution — About 4 species; Australia (2 species, Queensland, New South Wales) and *Malesia* (1 species, or possibly 2, Moluccas).

Morphology — Extensively reviewed by Nielsen, Baretta-Kuipers & Guinet, Opera Bot. 76 (1984) 5–120.



**55. Archidendron monopterum** (Kosterm.)

Nielsen, Opera Bot. 76 (1984) 96. — *Pithecellobium monopterum* Kosterm., Reinwardtia 3 (1954) 1, f. 1. — *Morolobium monopterum* (Kosterm.) Kosterm., Bull. Organ. Natuurw. Onderz. Indon. 20 (1954) 11, f. 1.

Small tree. Branchlets greyish, terete, glabrous. Stipules not seen. *Leaves*: rachis 3.5–5 cm, lenticellate, glabrous, gland circular, ± raised, concave, c. 1.5 mm in diameter; pinnae  $\frac{1}{2}$ –1 pair, 0.5–1.5 cm, glabrous, each bearing a terminal leaflet; leaflet subsessile, rigidly chartaceous, ± equal-sided, broadly elliptic, up to 37 by 18 cm, base rounded to half rounded/half cuneate, apex obtuse, both surfaces glabrous; principal lateral veins 9–11 per leaflet-half, arching; reticulation lax, pro-

minulous above, prominent beneath. *Inflorescences* ramiflorous at the old leaf-scars, not seen fully developed, glabrous, consisting of pedunculate glomerules arranged in short racemes; glomerules consisting of c. 3 sessile flowers; floral bracts ovate, acute, c. 1 mm. Flower buds with campanulate, glabrous, 5-dentate calyx. Ovary solitary. Mature flowers, pods and seeds unknown.

Distribution — *Malesia*: Moluccas (Morotai, Sangowu R.).

Note — A specimen collected in Obi Is. (*de Vogel* 4060) probably belongs here; it has narrowly elliptic or lanceolate leaflets, 11–21 by 3.5–7 cm; calyx narrowly campanulate, 3.5–5 mm long, truncate; corolla narrowly funnel-shaped, c. 8 mm; lobes oblong, c. 4 mm long (Nielsen, l.c.).

**7. Series Pendulosae**

*Archidendron* ser. *Pendulosae* (Mohlenbr.) Nielsen in Nielsen, Baretta-Kuipers & Guinet, Opera Bot. 76 (1984) 98. — *Pithecellobium* sect. *Archidendron* subsect. *Pendulosae* Mohlenbr., Webbia 21 (1966) 671.

Stipules and stipular scars absent; stipular glands seen in two species. Leaf-rachis and pinnae unwinged; pinnae plurifoliolate; leaflets petiolulate, not articulated into pits similar to the pinna-glands. *Inflorescences* cauliflorous, consisting of simple pendulous racemes or racemosely arranged few-flowered umbels or racemes; floral bracts eglandular. *Flowers* male and bisexual or male and female. Calyx neither inflated nor strongly ribbed. Ovaries (1)–2–6 per flower, sessile. *Pods* spirally contorted, coriaceous or fleshy, sometimes with wide necks between the seeds; seeds usually imbedded in the pericarp; dehiscence either simultaneously along both sutures or first along the dorsal suture.

Distribution — *Malesia*: Moluccas, New Guinea; 3 species.

Morphology — Extensively reviewed by Nielsen, Baretta-Kuipers & Guinet, Opera Bot. 76 (1984) 5–120.

Note — At least 5 more imperfectly known and not yet described species belong to this group.

KEY TO THE SPECIES

- 1a. Inflorescence a simple, unbranched raceme ..... **56. A. glabrum**
- b. Inflorescences consisting of pedunculate umbels or racemes aggregated into a synflorescence ..... 2
- 2a. Petiolules sparsely to densely puberulous; 2 or 3 very arched primary lateral veins per leaflet-half. Bracts subtending peduncles c. 0.5 mm long
  - 58. A. tenuiracemosum**
  - b. Petiolules glabrous; primary lateral veins 5–9 per leaflet-half, erecto-patent. Bracts subtending lateral peduncles 2 mm long ..... **57. A. hooglandii**

**56. *Archidendron glabrum* (K. Schum.) K.**

Schum. & Lauterb., Fl. Deut. Schutzgeb. Südsee (1900) 343, t. ix; De Wit, Bull. Bot. Gard. Buitenzorg 17 (1942) 266; Reinwardtia 2 (1952) 84; Verdc., Manual New Guin. Legum. (1979) 237, f. 58; Nielsen, Opera Bot. 76 (1984) 98, f. 67, 68. — *Hansemannia glabra* K. Schum., Bot. Jahrb. 9 (1888) 201; K. Schum. & Hollf., Fl. Kaiser Wilhelm Land (1889) 103. — *Albizia hansemannii* F. Muell., Proc. Linn. Soc. N.S.W. ser. 2, 5 (1890) 201 ('*hansemannii*'). — *Pithecellobium hansemannii* (F. Muell.) Mohlenbr., Webbia 21 (1966) 671, f. 5.

*Pithecellobium kubaryanum* Warb., Bot. Jahrb. 13 (1891) 335; Mohlenbr., Webbia 21 (1966) 719, f. 31. — *Archidendron kubaryanum* (Warb.) K. Schum. & Lauterb., Fl. Deut. Schutzgeb. Südsee (1900) 344; De Wit, Bull. Bot. Gard. Buitenzorg 17 (1942) 344; Reinwardtia 2 (1952) 96, sub spec. excl. vel imperf. notae.

*Archidendron dies-christi* De Wit, Reinwardtia 2 (1952) 81; Verdc., Manual New Guin. Legum. (1979) 236. — *Pithecellobium dies-christi* (De Wit) Mohlenbr., Webbia 21 (1966) 672, f. 6.

Shrub or small tree up to c. 7 m high, usually single-stemmed; d.b.h. 18 cm. Branchlets terete, minutely puberulous, glabrescent. Stipules or stipular glands not seen. *Leaves*: rachis 24–65 cm, densely puberulous or glabrous, glands circular, elliptic or transversely elliptic, raised, hollow, urceolate or crater-shaped, 1–5 mm in diameter, minutely puberulous or glabrous; pinnae 2–4 pairs, (6–)10–50 cm,  $\pm$  puberulous, glands crater-shaped, 0.5–1.5 mm in diameter, puberulous or glabrous; petiolules 5–6 mm,  $\pm$  puberulous or glabrous; leaflets 2–6 pairs per pinna, opposite, proximal pair occasionally subopposite, chartaceous, drying grey-green, unequal-sided, ovate, elliptic, or ovate-lanceolate, 4–22.5 by 3.5–9(–14) cm; base narrowly or broadly cuneate, apex acuminate; both surfaces glabrous or lower surface puberulous on the major veins; principal lateral veins 5 or 6 per leaflet-half, arching; reticulation prominulous above, raised beneath. *Inflorescences* cauliflorous, consisting of long, slender, puberulous racemes, 20–70 cm; floral bracts linear, c. 1 mm, pedicels 1.8–2.7 cm, solitary or paired, puberulous. *Flowers* pentamerous, male or bisexual. Calyx cup-shaped, 2–3(–4) mm, puberulous, truncate or with very small teeth, to 1 mm. Corolla pale green or greenish cream, funnel-shaped, 6–9 mm, shortly tomentose or densely appressed puberulous; lobes ovate, acute, 2–4 mm. *Stamens* white, 15–20 mm; tube equalling the corolla-

tube, but tube in bisexual flowers shorter, c. 4 mm or more. Ovaries 2–6 per flower, glabrous (in male flowers long, thin, translucent). *Pods* up to 3 per flower, bright red when young, becoming brown, velutinous at maturity, pale yellow to white inside, spirally contorted, usually moniliform, 8–24 cm, hard-fleshy or coriaceous, divided in up to 15 rounded compartments, 1–2.4 cm high, 1–1.8 cm wide, separated by necks 0.2–0.6 cm wide, veins inconspicuous, dehiscing along both sutures. *Seeds* black or bluish-black, ellipsoid, slightly compressed, 11–8 by 8–10 mm, with a red funicle.

*Distribution* — *Malesia*: Papua New Guinea (Morobe, Central, Northern, Eastern, and Milne Bay Provinces, incl. Normanby & Ferguson Is.).

*Habitat & Ecology* — Primary and secondary rain forest; altitude 0–1650 m.

*Field notes* — Common, scattered in the lower storey usually as a single-stemmed shrub with the leaves at the end of the stem. Bark grey-brown or pale brown with numerous horizontally stretched darker lenticels and with short longitudinal fissures; wood pale straw or straw.

*Note* — For extensive notes on the variation in this species, see Nielsen (l.c.: 98).

**57. *Archidendron hooglandii* Verdc., Kew**

Bull. 33 (1979) 407; Manual New Guin. Legum. (1979) 240; Nielsen, Opera Bot. 76 (1984) 100, f. 67, 69.

*Pithecellobium tenuiracemosum* auct. non (Kaneh. & Hatus.) Mohlenbr.: Mohlenbr., Webbia 21 (1966) 675, p.p., quoad *Hoogland* 4350.

Shrub up to 4 m tall. Branchlets terete, glabrous or minutely puberulous. Stipules not seen; stipular glands circular, concave, c. 0.5–1 mm. *Leaves*: rachis 2.5–6.5 cm, glabrous, gland circular, sessile,  $\pm$  depressed in the central part, c. 1 mm in diameter; pinnae 1 pair, 12–22 cm, glabrous, glands similar to the rachis-gland; petiolules 2–3 mm, glabrous; leaflets  $2\frac{1}{2}$ –3 pairs per pinna, opposite, chartaceous, drying pale green or olive-brown,  $\pm$  equal-sided, elliptic to oblong-elliptic, 6.5–23 by 3.5–8 cm, base broadly symmetrically cuneate, somewhat decurrent, apex short-acuminate to obtuse; both surfaces glabrous; principal parallel veins 5–9 per leaflet-half, erecto-patent, evenly distributed; reticulation prominulous above, prominent beneath. *Inflorescences* cauliflorous or ramiflorous, glabrous, slender, drooping, consisting of racemously arranged, slender pedunculate racemes, 1.5–15 cm long, main axis 11–35 cm long, peduncular bracts spurred, 2 mm, glabrous;

pedicels 6–11 mm, glabrous, floral bracts inconspicuous. *Flowers* pentamerous, male and bisexual, white. Calyx cupular, 1–2 mm, glabrous, inconspicuously dentate. Corolla funnel-shaped, 5.5–7 mm, glabrous; lobes ovate, acute, 2.5 mm. *Stamens* up to 24 mm, tube equalling the corollatube. Rudimentary ovaries 2 or 3 in male flowers, glabrous. *Pod* orange, curved or spirally contorted, c. 11 by 1.5 cm with distinct necks between the seeds, coriaceous-fleshy, glabrous, veins inconspicuous, dehiscing along the dorsal suture. *Seeds* not seen, said to be black.

Distribution – *Malesia*: Papua New Guinea (Milne Bay Prov. and Normanby Is.).

Habitat & Ecology – Lowland rain forest, also recorded from limestone; altitude 5–90 m.

Note – Specimens recorded by Verdcourt (l.c. 1979: 258) as belonging to 'sp. H' almost certainly belong here.

**58. *Archidendron tenuiracemosum*** Kaneh. & Hatus., Bot. Mag. Tokyo 56 (1942) 357; De Wit, Reinwardtia 2 (1952) 96, sub spec. excl.; Kosterm., Reinwardtia 3 (1954) 23, p.p., excl. *BS* 49023; Verdc., Manual New Guin. Legum. (1979) 253; Nielsen, Opera Bot. 76 (1984) 100, f. 67, 69. — *Pithecellobium tenuiracemosum* (Kaneh. & Hatus.) Mohlenbr., Webbia 21 (1966) 675, f. 7, p.p., excl. *Hoogland* 4350 & *BS* 49023.

*Archidendron affine* De Wit, Reinwardtia 2 (1952) 74.

*Abarema gracillima* Kosterm., Adansonia sér. 2, 6 (3) (1966) 367, pl. 3; Verdc., Manual New Guin. Legum. (1979) 215.

Shrub or small tree up to 4 m high. Branchlets terete, glabrous. Stipules not seen; stipular glands linear, very inconspicuous, c. 1.5 mm. *Leaves*: rachis (2.5–)3–10(–13) cm, puberulous or glabrous, glands circular, slightly raised, flat, 1–2 mm

in diameter; pinnae 1 pair, 3–18(–28) cm, puberulous or glabrous, glands circular, without raised margins, sometimes slightly concave, c. 1–1.5 mm in diameter; petiolules 3–5 mm, scarcely to densely puberulous; leaflets c. 2–4 pairs per pinna, opposite and often with an additional lower leaflet unpaired, chartaceous, drying grey to dull brown, equal-sided, ovate-elliptic, elliptic, or oblong-lanceolate, 7–31 by 3–10 cm, base symmetrically cuneate, apex shortly blunt-acuminate (or caudate), both surfaces glabrous; principal lateral veins 2 or 3 per leaflet-half, strongly arched, the lower occasionally forked in the proximal part, veins parallel to the margin of the leaflet for more than halfway, tertiary veins scalariform, reticulation prominent. *Inflorescences* cauliflorous or ramiflorous, glabrous or densely puberulous, probably not pendulous, consisting of racemously arranged umbels of 1–5 flowers, floral bracts inconspicuous, oblong-linear, 0.5–1 mm; pedicel 5–12 mm, glabrous. *Flowers* pentamerous, male and bisexual, pale green. Calyx cupular, 1–2 mm, with crenulate margin, glabrous. Corolla broadly funnel-shaped, 3.5–6.5 mm, glabrous; lobes ovate, acute, 2 mm, glabrous. *Stamens* white, (10–)20–30 mm, tube equalling the corollatube. Ovaries solitary or absent in male flowers, 2–3 in bisexual flowers, glabrous. *Pod* red, curved into a circle or spirally contorted, up to 10 by 1.5–2 cm, coriaceous, sometimes strongly constricted between the seeds due to abortion of some seeds, compartments oblong, c. 1 cm long, 2 cm wide, glabrous, veins invisible, dehiscing first along the dorsal suture. *Seeds* black, obovoid, slightly compressed, c. 12 by 8 mm.

Distribution – *Malesia*: Moluccas (Morobi, Obi), New Guinea (West Irian).

Habitat & Ecology – Dense primary rain forest on clayey soil; altitude 10–500 m.

Note – A poorly known species; for further notes see Nielsen, l.c.

## 8. Series *Bellae*

*Archidendron* series *Bellae* Nielsen in Nielsen, Baretta-Kuipers & Guinet, Opera Bot. 76 (1984) 100.

Stipules or stipular scars absent (stipules present in one species). *Leaf*: rachis and pinnae unwinged, pinnae plurifoliolate; leaflets petiolulate, opposite, not articulated in pits similar to the pinna-glands. *Inflorescences* erect, cauliflorous or terminal, consisting of few-flowered umbels or branched racemes; floral bracts eglandular. *Flowers* male and



female, or bisexual. Calyx neither inflated, nor strongly ribbed. Ovaries 2–8 per flower, sessile. *Pods* large and sausage-shaped, straight or  $\pm$  curved, only slightly flattened, probably hard-fleshy or coriaceous in fresh condition, woody when dried. *Seeds* black.

Distribution — *Malesia*: 4 species, all endemic to New Guinea.

Morphology & Taxonomy — Extensively reviewed by Nielsen, Baretta-Kuipers & Guinet (l.c.: 5–120).

Notes — Of two species the fruit is not yet known. The series is characterized by large leaves with leaflets drying chestnut-brown and with strong raised densely reticulate veins.

For the Keys to the species (1: flowering, and 2: fruiting material), see p. 88 and p. 92, respectively.

**59. *Archidendron bellum*** Harms, Bot. Jahrb. 55 (1917) 40; De Wit, Bull. Bot. Gard. Buitenzorg 17 (1942) 263; Reinwardtia 2 (1952) 77; Verdc., Manual New Guin. Legum. (1979) 231; Nielsen, Opera Bot. 76 (1984) 100, f. 70, 71. — *Pithecellobium bellum* (Harms) Mohlenbr., Webbia 21 (1966) 683, f. 12.

Shrub or small tree up to 12 m high, d.b.h. 10–20 cm, with sparse foliage near the top only. Branchlets terete, glabrous. Stipules or stipular scars not seen. *Leaves*: rachis up to 57 cm, very stout, scarcely puberulous, glands slightly raised, circular,  $\pm$  depressed in the central part, c. 1 mm in diameter; pinnae 2 or 3 pairs, 18.5–35 cm, scarcely puberulous, glands similar to rachis-glands; petiolules 3–7 mm,  $\pm$  glabrous; leaflets 3–5 pairs per pinna, opposite, coriaceous, drying grey-green or dark green above, chestnut-brown beneath,  $\pm$  equal-sided, elliptic, elliptic-oblong or oblong-lanceolate, 14–31.5 by 5–11 cm, base cuneate, sometimes tapering in the petiolule, apex tapering-acuminate, both surfaces glabrous, principal lateral veins 7 or 8 per leaflet-half, arching, reticulation dense and raised on both surfaces. *Inflorescences* cauliflorous, glabrous, consisting of once-branched racemes up to 15 cm long, branches up to 8 cm; floral bracts not seen; pedicels 2–8 mm, glabrous. *Flowers* tri- or pentamerous, bisexual. Calyx green, campanulate or subtubular, 7–16 mm, glabrous, irregularly lobed; lobes rounded up to 3 mm. Corolla white, funnel-shaped, 27–35 mm, glabrous; lobes oblong, acute, 9–15 mm. *Stamens* white, 45–55 mm; tube exceeding the corolla-tube, shorter than the corolla. Ovaries 2–5, glabrous, except for a few occasional hairs in the distal part at the base of the style. *Pod* green, probably sausage-shaped, c. 15 (–230) by 4–5 cm, hard-fleshy or coriaceous, or woody, very finely rusty pubescent outside, with thickened margins, mode of dehiscence not known.

*Seeds* black, with a glaucous bloom, ellipsoid, 33–36 by 20–28 by 22–24 mm.

Distribution — *Malesia*: New Guinea.

Habitat & Ecology — Rain forest, including hill-side forest on copper-rich soil; altitude (?50–)500–700 m.

Field notes — Bark light grey to dark brown, smooth or rather rough.

Note — The specimen recorded under 'sp. G' by Verdcourt (l.c.: 258) probably belongs here, but it has one pair of pinnae only.

**60. *Archidendron calliandrum*** De Wit, Reinwardtia 2 (1952) 80; Verdc., Manual New Guin. Legum. (1979) 233; Nielsen, Opera Bot. 76 (1984) 102, f. 70, 71. — *Pithecellobium calliandrum* (De Wit) Mohlenbr., Webbia 21 (1966) 687, f. 15. \*

*Pithecellobium megaphyllum* Kaneh. & Hatus., Bot. Mag. Tokyo 56 (1942) 360, f. 4; Kosterm., Adansonia sér. 2, 6 (3) (1966) 369.

*Archidendron kanehirae* Verdc., Kew Bull. 33 (1978) 126.

Tree up to 15 m high. Branchlets terete, glabrous. Stipules, stipular scars or stipular glands not seen. *Leaves*: rachis up to 50 cm, glabrous, glands obscure, circular, flat, slightly depressed in the central part, c. 1 mm in diameter; pinnae 1 or 2 pairs, 25–60 cm, glabrous to scarcely puberulous, glands similar to rachis-glands; petiolules 5–7 mm, glabrous; leaflets 3 or 4 pairs per pinna, opposite, coriaceous, drying grey-green above, brown-green beneath,  $\pm$  equal-sided, broadly elliptic, (ob)ovate-elliptic to oblong-elliptic, 11–38 by 6–16 cm, base  $\pm$  broadly cuneate, tapering into the petiolule, apex obtuse to obscurely acuminate, both surfaces glabrous, principal lateral veins 8 or 9 per leaflet-half, oblique, reticulation dense on both surfaces. *Inflorescences* cauliflorous, very thinly rusty pu-

berulous, consisting of pedunculate umbels aggregated into shortly branched panicles, 4.5–12 cm; umbels of c. 4 or 5 flowers; floral bracts not seen, pedicels 1–4 mm, shortly rusty puberulous. *Flowers* pentamerous, male or bisexual. Calyx narrowly campanulate, 7–10 mm, shortly rusty puberulous; teeth irregular, rounded to 2 mm. Corolla funnel-shaped, 20–25 mm, glabrous in proximal part, distal part of tube and lobes densely rusty sericeous; lobes triangular oblong, acute, 5–8 mm. *Stamens* 50–70 mm, tube equalling the corolla-tube. Ovaries 3 or 4, glabrous. *Pod* green, pendent, sausage-shaped, straight or slightly curved, twisted and undulate near the apex, 14.5–50 by 4–8.5 by 3.5–4 cm, not or but slightly constricted between the seeds, coriaceous or woody, strongly striate or rugose, glabrous, veins inconspicuous, dehiscing along the dorsal suture. *Seeds* black with a distinct bloom, subglobose or subglobose-cylindrical, c. 30–45 by 22–32 by 20–30 mm.

Distribution – *Malesia*: New Guinea.

Habitat & Ecology – Primary rain forest, on clayey soil; altitude 10–200 m.

Note – Morphologically close to *A. bellum* (Nielsen, l.c.).

**61. *Archidendron forbesii*** Baker f., J. Bot. 61 (1923) Suppl. 12; De Wit, Bull. Bot. Gard. Buitenzorg 17 (1942) 266; Reinwardtia 2 (1952) 83; Verdc., Manual New Guin. Legum. (1979) 237; Nielsen, Opera Bot. 76 (1984) 102, f. 70, 71. — *Pithecellobium forbesii* (Baker f.) Mohlenbr., Webbia 21 (1966) 691, f. 17.

Tree up to 24 m high, bole stout, up to 7 m, d.b.h. 45 cm. Branchlets terete, glabrous. Stipules not seen; stipular glands linear, c. 0.5 mm. *Leaves*: rachis up to 16 cm, glabrous or minutely puberulous, glands circular, with slightly raised margins and a central orifice, 1–2 mm in diameter; pinnae 1–4 pairs, 7–17 cm, scarcely puberulous, glabrescent, glands  $\pm$  similar to the rachis-glands; petiolules 5–6 mm, glabrous; leaflets 2–4 pairs per pinna, opposite, with an additional unpaired basal one, coriaceous, drying dark chestnut-brown,  $\pm$  equal-sided, ovate or broadly elliptic, 10–26 by 4–11.5 cm, base broadly cuneate, slightly tapering into the petiolule, apex obscurely acute or acuminate, both surfaces glabrous, principal lateral veins 7 or 8 pairs per leaflet-half, arching, reticulation very dense and raised on both surfaces. *Inflorescences* both cauliflorous and terminal, minutely scattered-puberulous, consisting of branched panicles, up to 20 cm, flowers racemously arranged on lateral branches up to 11 cm; floral bracts ovate, con-

cave, c. 3 mm; pedicels 0.5–1.5 cm, glabrous. *Flowers* pentamerous, bisexual. Calyx green, subcampanulate or cup-shaped, 12–14 mm, margin irregularly shallowly lobed. Corolla creamy-white, funnel-shaped, 22–30(–35) mm, golden tomentellous especially in distal part; lobes oblong, acute, c. 15 mm. *Stamens* creamy white, up to 50 mm, tube equalling the corolla-tube. Ovaries 5–8, pubescent. Pods and seeds unknown.

Distribution – *Malesia*: Papua New Guinea (Central Prov.).

Habitat & Ecology – Rain forest at c. 480 m altitude.

Field notes – Bark dark grey; wood straw, moderately hard and heavy.

**62. *Archidendron rufescens*** Verdc., Kew Bull. 32 (1977) 230; Manual New Guin. Legum. (1979) 251; Nielsen, Opera Bot. 76 (1984) 102, f. 70, 71. — *Pithecellobium rufescens* Mohlenbr., Webbia 21 (1966) 688, f. 16, non Pittier (1916).

Tree up to 21 m high. Branchlets terete, densely rusty tomentose, glabrescent. Stipules inconspicuous, rigid, c. 1 mm. *Leaves*: rachis 19–29 cm, terete, glabrous, glands not seen; pinnae 2 pairs, 9–24 cm, glands not seen, petiolules c. 5 mm, glabrous; leaflets 3 or 4 pairs per pinna, opposite, coriaceous, drying grey-green above, brown-green beneath, unequal-sided, ovate-elliptic or elliptic, 8.5–18 by 4.5–8 cm, base asymmetrically cuneate or rounded, apex obtuse or obscurely acuminate, upper surface glabrous, lower glabrous except for the major veins, principal lateral veins c. 8 per leaflet-half, arching, reticulation dense, slightly raised on both surfaces. *Inflorescences* cauliflorous, rusty tomentose, consisting of racemes aggregated into panicles to 32 cm, lateral branches 13–19 cm, peduncles up to 7 cm long; floral bracts not seen; pedicels 2–3 mm, tomentose. *Flowers* male, pentamerous. Calyx green, campanulate with slightly undulate margin, 6–8 mm, rusty tomentose. Corolla cream inside, brown outside, funnel-shaped, 20–24 mm, densely rusty puberulous; lobes linear-oblong, acute, c. 10–12 mm. *Stamens* cream, 55–65 mm, tube equalling the corolla-tube. Ovaries not seen (5–7 and villous according to Mohlenbrock, l.c.). Pod and seeds unknown.

Distribution – *Malesia*: Papua New Guinea (Sepik Prov.).

Habitat & Ecology – Montane forest; altitude c. 900 m. Fl. July.

Note – For further notes on this species, see Nielsen, l.c.

## DUBIOUS SPECIES

*Archidendron fallax* Harms, Notizbl. Berlin-Dahlem 10 (1928) 274; Verdc., Manual New Guin. Legum. (1979) 236; Nielsen, Opera Bot. 76 (1984) 106.

A dubious taxon; further material is needed.

*Archidendron mucronatum* Harms, Notizbl. Berlin-Dahlem 10 (1928) 274; Nielsen, Opera Bot. 76 (1984) 106.

A dubious taxon close to *A. beguinii* and *A. lucyi* (both in ser. *Archidendron*).

## ARCHIDENDROPSIS

*Archidendropsis* Nielsen, Fl. Nouv.-Caléd. et Dépend. 12 (1983) 66; in Nielsen, Guinet & Baretta-Kuipers, Bull. Mus. Natn. Hist. Nat. Paris, sér. 4, 5, sect. B, Adansonia no 3 & 4 (1983) 325, 335.

*Albizia* § 1 *Spiciflorae* Benth., Lond. J. Bot. 3 (1844) 85, p.p.

*Albizia* sect. II *Lophantha* (Miq.) Fourn., Ann. Sc. Nat. Bot. sér. 4, 15 (1861) 172.

*Albizia* sect. *Spiciflorae* Benth. ser. *Platyspermae* Benth., Trans. Linn. Soc. 30 (1875) 558.

*Albizia* sect. *Spiciflorae* Benth. emend. Fosb., Reinwardtia 7 (1965) 73, p.p.

'Gen. B' Nielsen in Polhill & Raven (eds.), Adv. Leg. Syst. 1 (1981) 186.

Unarmed shrubs or trees. Stipules filiform or auriculate, generally caducous. *Leaves* bipinnate, rachis and most often pinnae with extrafloral nectaries; leaflets opposite or alternate. *Inflorescences* consisting of pedunculate spikes, spiciform racemes, or (in one species) glomerules. *Flowers* uniform, tetra- or pentamerous, bisexual. Calyx connate, valvate. Corolla connate, valvate. *Stamens* numerous, united into a tube at the base. Ovary solitary or several together. *Pods* (not known in Malesian species) chartaceous(-coriaceous), flat (or sometimes turgid), straight (or sometimes curved), dehiscing mostly along both sutures, not segmented, not reddish inside; endocarp not separating from the exocarp, not forming separate envelopes around the seeds. *Seeds* flattened (or sometimes turgid), narrowly winged when flat, brown or black, without aril, testa thin, without areole, endosperm absent; cotyledons large, sometimes green, radicle curved.

Distribution — *Malesia* (New Guinea, Bismarck Arch.), Solomon Islands, NE Australia (Queensland), New Caledonia; 14 species in all, of which 2 in *Malesia*.

Habitat & Ecology — Usually rain forest trees, but two of the Australian species found in drier habitats. Seeds without dormancy. All species have a very restricted area of distribution.

Morphology & Taxonomy — The morphology of this genus is extensively reviewed by Nielsen, Guinet & Baretta-Kuipers (l.c., Adansonia no 3: 304). *Archidendropsis* has been divided into two subgenera (cf. Nielsen et al., l.c.: 335), based on stipule and pollen characters. Subgenus *Basaltica* Nielsen, with rigid stipules, small polyads, and pollen with a narrow pore diameter, 2.5–3  $\mu\text{m}$ , has 3 species in Australia, all endemic. Subgenus *Archidendropsis*, with larger polyads and a pollen pore diameter of 6–10  $\mu\text{m}$  comprises the extra-Australian species.



## KEY TO THE SPECIES

- 1a. Leaflets 4–6 pairs per pinna, oblong, 3.5–13.5 by 1.8–5 cm . . . . 2. *A. spicata*  
 b. Leaflets (5–)11–25 pairs per pinna, oblong or subfalcate, (0.5–)0.7–1.6 by (0.3–)0.5–0.7 cm . . . . . 1. *A. sepikensis*

1. *Archidendropsis sepikensis* (Verdc.) Nielsen, Bull. Mus. Natn. Hist. Nat. Paris, sér. 4, 5, sect. B, Adansonia no 3 & 4 (1983) 326, 343. — *Albizia sepikensis* Verdc., Kew Bull. 32 (1978) 473; Manual New Guin. Legum. (1979) 193.

Tree to 24 m high, trunk to 18 m, 37 cm in diameter; bark pale, whitish, Young branches densely ferrugineously tomentose, with linear lenticels. Stipules oblong-lanceolate, acute, 10–14 by 3–4 mm, densely tomentellous, caducous. *Leaves*: rachis 15–34 cm, rusty hirsute or tomentose, petiole 3.5–6 cm, with glands at or slightly below the junctions of the pinnae, elliptic to circular, sessile, with raised, sharp margins, 1.5–3 mm in diameter; pinnae 6–14 pairs, (3–)5.5–13 cm, tomentose; leaflets (5–)11–25 pairs per pinna, opposite, sessile, thinly chartaceous, asymmetrically oblong or subfalcate, (0.5–)0.7–1.6 by (0.3–)0.5–0.7 cm, base half truncate-rounded/half cuneate, apex asymmetrically rounded, both surfaces glabrous, but mid-main vein and margin ciliate; lateral veins prominent, reticulate on both surfaces. *Inflorescences* consisting of pedunculate spiciform racemes aggregated into axillary panicles at the distal leaves, tomentose or hirsute, racemes 1.5–5.5 cm, peduncle c. 2.5 cm, pedicel 0.5–2 mm, subtended by inconspicuous bracts. *Flowers* pentamerous, white, bisexual. Calyx campanulate, densely sericeous, 2–2.5 mm; teeth triangular-deltoid, acute, 0.5–1 mm. Corolla funnel-shaped, sericeous, 5–5.3 mm; lobes oblong-lanceolate, acute-acuminate, 2.2–3.5 mm. *Stamens* 14–20 mm, tube 3–4 mm, exceeding the corolla-tube. Ovary 1–2 mm, solitary, sessile or shortly stipitate, glabrous or puberulous. *Pod* (not known in ripe state) oblong, flat, with slightly thickened margins, 8.5–16.5 by 2–3 cm; valves with obscure, reticulate veins and a few scattered hairs, possibly glabrescent. Seeds unknown.

Distribution – *Malesia*: New Guinea.

Habitat & Ecology – Rain forest on basaltic soil; altitude up to 350 m.

Note – Only known from two collections, the type being from the West Sepik Prov., Papua New Guinea. The single specimen from West Irian has

a puberulous, sessile ovary, and may belong to a distinct subspecies or species (cf. Nielsen, l.c.).

2. *Archidendropsis spicata* (Verdc.) Nielsen, Bull. Mus. Natn. Hist. Nat. Paris, sér. 4, 5, sect. B, Adansonia no 3 & 4 (1983) 326, 343. — *Archidendron spicatum* Verdc., Kew Bull. 32 (1977) 229; Manual New Guin. Legum. (1979) 253.

Tree to 42 m high, trunk to 25 m, to 90 cm in diameter; bark light brown or grey-brown with prominent vertical lines of lenticels. Young branches rusty tomentose, glabrescent. Stipules not seen. *Leaves*: rachis 2.2–9.5 cm, densely rusty tomentose, glabrescent, petiole 2.2–3 cm, with gland(s) at the junctions of the pinnae, circular or triangular in outline, slightly raised, flat, 1.5–2 mm in diameter; pinnae 1 or 2 pairs, 11.5–16.5 cm, densely rusty tomentose; leaflets 4–6 pairs per pinna, opposite, petiolulate, chartaceous, oblong, 3.5–13.5 by 1.8–5 cm, base asymmetrically rounded or  $\pm$  subcordate; apex obtusely acuminate; both surfaces glabrous, on the main vein slightly puberulous above, lateral veins prominulous, reticulate. *Inflorescence*: spikes solitary or paired in the distal leaf-axils, 15–35 cm, puberulous, with inconspicuous caducous bracts, c. 0.2 mm, placed c. 2 mm below the flowers. *Flowers* pentamerous. Calyx pale green, cup-shaped, 2 mm, puberulous, margins slightly undulate. Corolla white, funnel-shaped, 5–6 mm, sericeous in the distal part, glabrous in the proximal part; lobes triangular-ovate, acute, 1.5–2.5 mm. *Stamens* c. 16 mm, tube c. 3 mm, equalling the corolla-tube. Ovary solitary, substipitate, 1–1.5 mm, villous. *Pod* (not known in ripe state) oblong, flat with raised margins, rusty tomentose, c. 24 by 1.6 cm. Seeds unknown.

Distribution – *Malesia*: New Guinea (Umboi Is.), New Britain.

Habitat & Ecology – Lowland rain forest; altitude 15–200 m.

Note – In habit very similar to *Archidendropsis oblonga* (Hemsley) Nielsen from the Solomon Islands, but the latter has larger flowers with several ovaries and flowers arranged in racemes (see also Verdcourt 1979).

## CATHORMION

*Cathormion* Hassk., *Retzia* 1 (1855) 231; Kosterm., *Bull. Organ. Natuurw. Onderz. Indon.* 20 (1954) 11; Hutch., *Gen. Fl. Pl.* 1 (1964) 297; Burkart, *Darwiniana* 13 (1964) 428; Brenan & Brummitt, *Bol. Soc. Brot.* 39 (1965) 192.

Shrub armed by spinescent stipules and ramose spines. *Leaves* bipinnate; rachis and pinnae with extrafloral nectaries; leaflets opposite, sessile. *Inflorescences* composed of pedunculate corymbs. *Flowers* bisexual, pentamerous, dimorphic. Calyx connate, valvate. Corolla connate, valvate. *Stamens* numerous, united into a tube at the base, merging with the corolla-tube. Ovary solitary, sessile. *Pods* woody, dark brown,  $\pm$  moniliform,  $\pm$  curved, separating into one-seeded, indehiscent segments at maturity; exocarp loosening irregularly at maturity. *Seeds* with a hard testa, with pleurogram, wingless; aril absent; endosperm absent; cotyledons large, radicle curved. — **Fig. 19.**

**Distribution** — About 12 species in tropical and subtropical South America and Africa, and 1 species in the SE Asia/Australia region.

**Habitat & Ecology** — Most of the species are restricted to areas with a tropical seasonal climate, e.g. savanna and woodland.

**Taxonomy** — A genus of uncertain delimitation. Most of the species considered members of *Cathormion* were formerly referred to *Pithecellobium* sect. *Samanea* Benth. [Trans. Linn. Soc. 30 (1875) 585]. In a review of the genera of *Ingeae* [Nielsen in Polhill & Raven (eds.), *Adv. Leg. Syst.* 1 (1981) 180] it was suggested to refer the members of this genus to *Albizia* because of all the transitions found, from species with indehiscent, segmented pods to species with segmented, dehiscent pods, and species with indistinctly segmented and dehiscent pods. The Asian-Australian species is the only member of the genus with stipular spines and often also axillary spines. Because of the aberrant pollen morphology (Guinet, in litt.) it seems preferable now to consider the genus monotypic, and to refer the African and American species, formerly included in *Cathormion*, to *Albizia*.

***Cathormion umbellatum*** (Vahl) Kosterm., *Bull. Organ. Natuurw. Onderz. Indon.* 20 (1954) 12; *Adansonia sér.* 2, 6 (3) (1966) 359; Verdc., *Manual New Guin. Legum.* (1979) 203; Kosterm., *Rev. Handb. Fl. Ceyl.* 1 (1980) 475; Nielsen, *Fl. Camb. Laos Vietnam* 19 (1981) 103, pl. 19: 1–8; *Fl. Thailand* 4, 2 (1985) 201, f. 51: 1–8. — *Mimosa umbellata* Vahl, *Symb. Bot.* 2 (1790) 103. — *Inga umbellata* (Vahl) Willd., *Sp. Pl. ed. 4*, 4 (1806) 1027. — *Pithecellobium umbellatum* (Vahl) Benth., *Lond. J. Bot.* 3 (1844) 202; Miq., *Fl. Ind. Bat.* 1 (1855) 37; *Sumatra* (1860) 105; Backer & Bakh. f., *Fl. Java* 1 (1963) 551. — *Feuilleea umbellata* (Vahl) O. Kuntze, *Rev. Gen. Pl.* 1 (1891) 188.

*Inga concordiana* DC., *Prod.* 2 (1825) 441; G. Don, *Gen. Hist.* 2 (1832) 395. — *Mimosa concordiana* Roxb., *Fl. Ind. ed. 2*, 2 (1832) 556.

*Pithecellobium malayanum* Pierre, *Fl. Cochinch.* 5 (1899) t. 394A; Craib, *Fl. Siam. Enum.* 1, 3 (1928) 560.

## KEY TO THE SUBSPECIES

- 1a. Pinnae 2–4 pairs; leaflets 5–13 pairs per pinna, with 3–4 accessory veins ascending from the base of the main vein, 1–1.5 by 0.3–0.7 cm, except for the distal pair  $\pm$  similar. Seeds suborbicular-obovate. Mainland Asia (Ceylon, S India, Thailand, Cambodia, S Vietnam)  
subsp. **umbellatum**
- b. Pinnae 1 or 2 (or 3) pairs; leaflets (3–)5–8 pairs per pinna, with 2 or 3 accessory veins ascending from the base of the main vein, (0.8–)1.3–3.5 by (0.3–)0.6–2 cm, usually increasing gradually in size from proximal to distal pair. Seeds elliptic-obovate or ovate-elliptic in outline . . . subsp. **moniliforme**

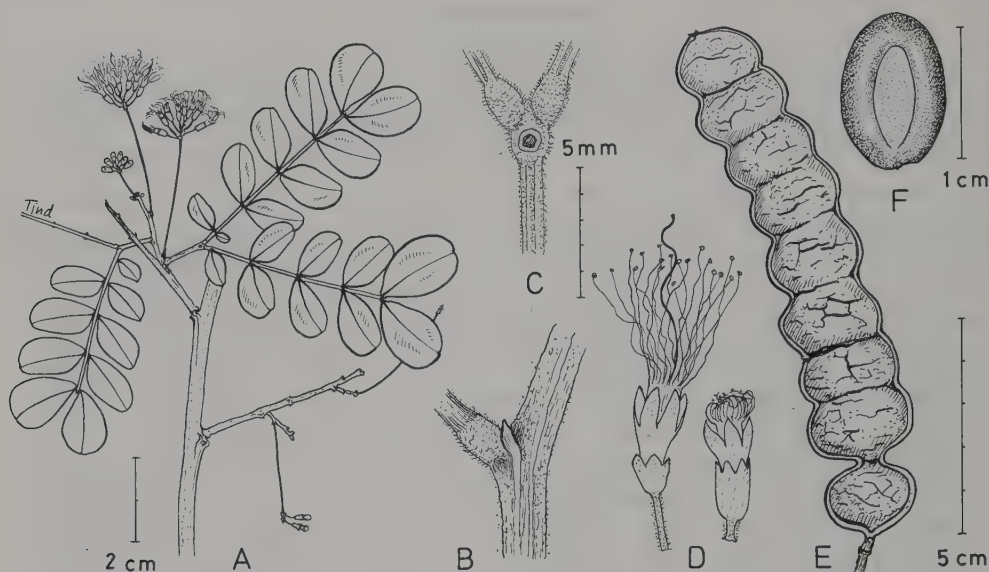


Fig. 19. *Cathormion umbellatum* (Vahl) Kosterm. subsp. *moniliforme* (DC.) Brummitt. A. Flowering branch with axillary spine; B. small stipular spines; C. nectary at top of rachis; D. flowers, marginal left, central right; E. pod; F. seed (A–D: Muchtar 38; E, F: Kostermans et al. KK & SS 15).

subsp. **moniliforme** (DC.) Brummitt, Kew Bull. 24 (1970) 231; Verdc., Manual New Guin. Legum. (1979) 204. — *Inga moniliformis* DC., Prod. 2 (1825) 440. — *Pithecellobium moniliforme* (DC.) Benth., Lond. J. Bot. 3 (1844) 211; Fl. Austral. 2 (1864) 424; Trans. Linn. Soc. 30 (1875) 585; Bailey, Qld. Fl. 2 (1900) 520. — *Pithecellobium umbellatum* (Vahl) Benth.  $\beta$  *moniliforme* (DC.) Miq., Fl. Ind. Bat. 1 (1855) 38. — *Cathormion moniliforme* (DC.) Hassk., Retzia 1 (1855) 231; Kostermans, Adansonia sér. 2, 6 (3) (1966) 359. — *Albizia moniliforme* (DC.) F. Muell., J. Bot. 10 (1872) 10; Ic. Aust. Acacia Dec. 13 (1888) 3. — *Feuillea moniliforme* (DC.) O. Kuntze, Rev. Gen. Pl. 1 (1891) 188. — *Cathormion umbellatum* forma *moniliforme* (DC.) Kosterm., Bull. Organ. Natuurw. Onderz. Indon. 20 (1954) 14. *Albizia amoenissima* F. Muell., Fragm. 8 (1872/74) 165; *ibid.* 9 (1875) 179.

Tree 4–22 m high, d.b.h. up to 60 cm, often crooked and multistemmed, flat-topped; young stems, suckers and coppice shoots with stipular spines to at least 3 cm long. Branchlets terete, striate, brown with lighter coloured, transverse lenti-

cels, puberulous, glabrescent. Stipules spinescent, inconspicuous, in fertile shoots c. 1 mm. *Leaves*: rachis 4–5 cm, short-puberulous or hirsute, sulcate, with glands at the junctions of the pinnae, elliptic to circular in outline, 0.5 mm in diameter; margins raised, central part strongly concave; pinnae 1 or 2 (or 3) pairs, patently puberulous-hirsute, sulcate, 5–12.5 cm, glands, if present, at the junctions of the leaflets, 0.2 mm in diameter, shaped as the rachis-glands; leaflets sessile, (3–) 5–8 pairs per pinna, usually increasing in size towards the apex of the pinna, obliquely ovate to (sub)trapezoid, the terminal pair obliquely obovate, (0.8–)1.3–3.5 by (0.3–)0.6–2 cm, base asymmetrically cuneate, or half rounded/half truncate, apex broadly rounded or slightly emarginate, both sides glabrous except for the major veins, or lower surface sparsely appressed-puberulous or sparsely hirsute; main vein diagonal, with 2 or 3 prominent accessory veins issuing from the base at the basicopic side; lateral veins prominulous, reticulate. Peduncles axillary or, usually, on short lateral branches which after fruiting develop into axillary spines in the axils of bracts or unipinnate leaves; corymbs at least 16-flowered, peduncles 2–4 cm, glabrous to hirsute; pedicel 1.5–5 mm, stouter



in central flowers. *Flowers* bisexual, dimorphic, creamish or white. *Marginal flowers* pentamerous; calyx  $\pm$  circumscissile at base, tubular or narrowly campanulate (or cup-shaped), glabrous or sparsely puberulous to setose, 1.5–2.5 mm; teeth triangular, acute, hairy, 0.3–0.5 mm; corolla funnel-shaped or narrowly campanulate, distal part and lobes puberulous or setose to sericeous, 5–6.5 mm; lobes triangular-ovate, acute, 1.5–1.8 mm; stamens numerous, c. 15 mm, tube equalling the corolla-tube to equalling the corolla or longer; ovary sessile, glabrous, c. 2 mm. *Central flower(s)* usually on a short and stout pedicel; calyx 5–10-merous, broadly tubular, 1.5–2.5 mm; corolla funnel-shaped, 3–4 mm, lobes less than calyx teeth; staminal tube thick, as long as the corolla-tube or exserted; ovary sessile, glabrous. *Pod* dark brown to black, indehiscent, straight to curved,  $\pm$  moniliform, up to 20 by 1.9–2.5 cm, breaking up in one-seeded segments, puberulous or glandular punctate, glabrescent, segments  $\pm$  rounded, thick, 1.9–2.5(–3.2) cm; exocarp thin and flaky, with strongly raised veins; mesocarp corky-woody; endocarp parchment-like. *Seeds* chestnut-brown with a light chestnut areole, elliptic-(ob)ovoid, 11–15 by 8–12 by 2–2.1 mm; areole elliptic-(ob)lan-ceolate, closed or with a narrow opening towards the hilum, 7–12 by 2.5–6 mm. — **Fig. 19.**

**Distribution** — Australia (Queensland, Northern Territory, W Australia); in *Malesia*: Sumatra (incl. Krakatau), Java, Madura, Kagean Is., Saleijer Is., Celebes, Moluccas (Sanana, Seram, Banda), Lesser Sunda Islands (Bali, Lombok, Komodo, Alor, Flores, Sumba, Sumbawa, Timor), New Guinea. — **Fig. 20.**

**Habitat & Ecology** — Inner parts of mangrove, behind sandy sea-shores, in gallery woodland, edges of swamps, at rivermouths, riverine forest and savanna; soil clayey or sandy; altitude 0–c. 150 m.

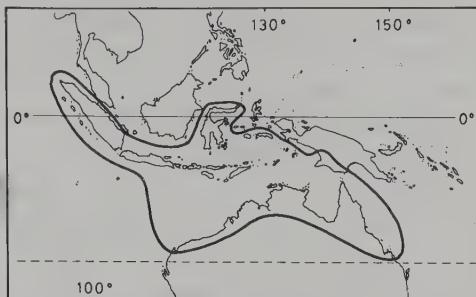


Fig. 20. Range of *Cathormion umbellatum* (Vahl) Kosterm. subsp. *moniliforme* (DC.) Brummitt.

The one-seeded segments of the pod can be dispersed by sea currents. Fl., fr. throughout the year. Flowering when the leaves are unfolding.

**Field notes** — Bark rough and flaky, grey-brown or light brown, deeply longitudinally fissured; inner bark red; sapwood white or straw; heartwood dark brown. Leaves dark green, shining, withering yellow.

**Morphology** — Often with spiny coppice-shoots. In young branches the stipules are triangular-acute and rigid, becoming spinescent in old branches. The flowering short-shoots have often leaves with one pair of pinnae, but leaves with two pairs of pinnae can be seen in most collections.

**Taxonomy** — Verdcourt (l.c.) wondered if more than one taxon was involved because of the very variable indumentum and pod characters. However, as judged from the scarce material, these characters seem to be mutually independent. Here, the subdivision as suggested by Brummitt (l.c.) is followed, although the Australian specimens still may prove to belong to a distinct subspecies.

## PARARCHIDENDRON

*Pararchidendron* Nielsen in Nielsen, Guinet & Baretta-Kuipers, Bull. Mus. Natn. Hist. Nat. Paris, sér. 4, 5, sect. B, Adansonia no 3 (1983) 327; *ibid.*, sér. 4, 6, sect. B, Adansonia no 1 (1984) 79.

Unarmed shrubs or trees. Stipules linear or filiform, not spinescent. *Leaves* bipinnate, rachis and pinnae with extrafloral nectaries; leaflets alternate. *Inflorescences* consisting of axillary pedunculate corymbs, often paired, on short-shoots. *Flowers* uniform, pentamerous, bisexual. Calyx connate, valvate. Corolla connate, valvate. *Stamens* numerous, united into a tube at the base. Ovary solitary. *Pods* chartaceous, flattened, curved into a circle or contorted, not segmented, reddish inside, the endocarp not forming separate

envelopes around each seed, pods dehiscent first along the ventral suture. *Seeds* ellipsoid, obovate or subglobose, with pleurogram, aril absent, wingless, testa thick; endosperm absent, cotyledons large. — **Fig. 22.**

**Distribution** — A monotypic genus distributed from Java to NE Australia (Queensland, N New South Wales).

**Habitat & Ecology** — In Australia reported from rain forest, coastal scrub and semi-deciduous forest; altitude up to 800 m, in Malesia found in hilly and montane rain forest at 400–2250 m.

**Morphology & Taxonomy** — The morphology of this genus is extensively reviewed by Nielsen, Guinet & Baretta-Kuipers (l.c. 1983: 304). In habit the genus is similar to *Archidendron* but differing by alternate leaflets and areolate seeds.

**Pararchidendron pruinosum** (Benth.) Nielsen, Bull. Mus. Natn. Hist. Nat. Paris, sér. 4, 5, sect. B, Adansonia no 3 (1983) 328; *ibid.*, sér. 4, 6, sect. B, Adansonia no 1 (1984) 80. — *Pithecellobium pruinosum* Benth., Lond. J. Bot. 3 (1844) 211; Fl. Austral. 2 (1864) 423; Pedley, Austrobaileya 1 (1981) 377. — *Albizia pruinos* (Benth.) F. Muell., J. Bot. 10 (1872) 9. — *Feuillea pruinos* (Benth.) O. Kuntze, Rev. Gen. Pl. 1 (1891) 188.

*Acacia sapindoides* A. Cunn. ex Sweet, Hort. Brit. ed. 3 (1839) 198, nom. nud. — *Pithecellobium sapindoides* (A. Cunn. ex Sweet) Domin, Bibl. Bot. 3 (1926) 830; Backer & Bakh. f., Fl. Java 1 (1963) 551, nom. inval. — *Abarema sapindoides* (A. Cunn. ex Sweet) Kosterm., Bull. Organ. Natuurw. Onderz. Indon. 20 (1954) 38, f. 25; Adansonia sér. 2, 6 (3) (1966) 358; Verdc., Manual New Guin. Legum. (1979) 219, nom. inval.

**Distribution** — Four varieties can be recognized; one, var. *pruinsum*, is restricted to Australia, the three remaining ones are endemic to Malesia. — Fig. 21.

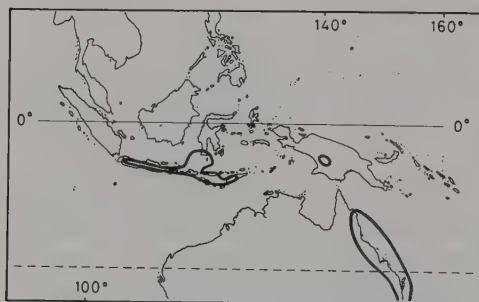


Fig. 21. Distribution of *Pararchidendron pruinosum* (Benth.) Nielsen.

#### KEY TO THE VARIETIES

- 1a. Apex of leaflets rounded, obtuse, or acuminate . . . . . 2
- b. Apex of leaflets acute, subcaudate or acuminate-mucronulate **b. var. novo-guineense**
- 2a. Inflorescence, young branches and leaf-rachises subglabrous to densely tomentose . . . . . 3
- b. Inflorescence, young branches and leaf-rachises velutinous to hirsute **c. var. sumbawaense**
- 3a. Young parts of plants subglabrous or short-tomentose. Australia (Queensland, N New South Wales) . . . . . var. *pruinsum*
- b. Young parts densely rusty tomentose **a. var. junghuhnianum**

**a. var. junghuhnianum** (Benth.) Nielsen, Bull. Mus. Natn. Hist. Nat. Paris, sér. 4, 5, sect. B, Adansonia no 3 (1983) 328; *ibid.*, sér. 4, 6, sect. B, Adansonia no 1 (1984) 83. — *Pithecellobium junghuhnianum* Benth. in Miq., Pl. Jungh. 1 (1852) 269; Miq., Fl. Ind. Bat. 1 (1855) 39; Benth., Trans. Linn. Soc. 30 (1875) 579. — *Cathormion junghuhnianum* (Benth.) Hassk., Retzia 1 (1855) 232; *ibid.* ed. 2, 1 (1858) 272. — *Albizia junghuhniana* (Benth.) F. Muell., J. Bot. 9 (1872) 9. — *Feuillea junghuhniana* (Benth.) O. Kuntze, Rev. Gen. Pl. 1 (1891) 188. *Inga tenggerensis* Zoll. & Mor., Nat. Geneesk. Arch. Ned. Ind. 3 (1846) 81. — *Albizia tenerensis* Miq., Fl. Ind. Bat. 1 (1855) 25.

Tree 6–20 m high, to 50 cm in diameter; bark grey or dark brown. Branchlets terete, slightly ridged by decurrent ridges from the leaf-scars, densely rusty tomentose. Stipules linear to filiform, acute, 1–3.5 mm. *Leaves*: rachis 2–16 cm, densely rusty tomentose, petiole 2–7 cm, with a



Fig. 22. *Pararchidendron pruinosum* (Benth.) Nielsen var. *junghuhnianum* (Benth.) Nielsen. A. Flowering branch; B. nectary on rachis; C. dehiscing pod with seed (A, B: Koorders 14155; C: Koorders 14174).

gland at or below the middle, 1.3–3.3 cm above the base, circular, flat to concave, sessile, 0.8–1.5 mm in diameter; pinnae (1–)2–3(–4) pairs, densely rusty tomentose, (2.5–)3–13.3 cm; leaflets 3–5(–7) pairs per pinna, alternate, petiolulate, chartaceous, drying green, unequal-sided, either asymmetrically ovate, obovate, elliptic, ovate-rhomboid, or subtrapezoid(-lanceolate), (1–)2–8.4 by (0.3–)0.7–4.2 cm, base asymmetrically cuneate or half cuneate/half rounded, apex rounded to acuminate or obtuse, both surfaces puberulous or subglabrous; main vein central or subcentral, lateral veins numerous, prominent, reticulate. *Inflorescences*: peduncles 4–9 cm, densely rusty tomentose; pedicels c. 4–5 mm; bracts oblong, spatulate, concave, c. 1 mm. *Flowers*: calyx green, cup-shaped, 1–1.5 mm,  $\pm$  densely appressed pu-

berulous or sericeous; teeth triangular, acute, 0.1–0.5 mm. Corolla yellowish green, tubular, slightly widened in the distal part, 5.5–6.5 mm, appressed-puberulous or sericeous; lobes triangular-ovate, acute, 0.5–1(–2) mm. *Stamens* 12 mm; white or cream, turning orange; tube 4–5.5 mm, at base shortly united with the corolla-tube,  $\pm$  equalling the corolla-tube. Ovary 1–2.5 mm, glabrous, stipe 2–4 mm. *Pods* yellowish to brown outside, reddish inside, forming a circle, 4–5 cm in diameter, chartaceous, valves puberulous or densely pilose, 1.1–1.7 cm wide,  $\pm$  sinuate between the seeds. *Seeds* glossy black, ellipsoid, obovate or subglobose 4–8 by 3–4.5 mm, areole with pleurogram parallel to and c. 1 mm from the margin, open towards the hilum; funicle thick, twice contorted. — **Fig. 22.**



Distribution — *Malesia*: Java, Celebes (P. Saleier), Lesser Sunda Islands (Bali, Lombok, Sumba, Timor).

Habitat & Ecology — Montane forest, heath forest, also on volcanic soil; altitude 400–1700 m. Fl., fr. Aug.–May.

**b. var. novo-guineense** Nielsen, Bull. Mus. Natn. Hist. Nat. Paris, sér. 4, 5, sect. B, Adansonia no 3 (1983) 328; *ibid.*, sér. 4, 6, sect. B, Adansonia no 1 (1984) 84.

Shrub or tree to 30 m high, d.b.h. 50 cm. Indumentum of inflorescence, young branches and leaf-rachis ± densely puberulous. Petiolar glands stipitate or sessile; leaflets glabrous, but main vein scattered pilose; apex strongly acuminate-caudate or acute, or if obtuse then mucronulate. Calyx 1.2–1.5 mm. Corolla 5.2–5.5 mm long.

Distribution — *Malesia*: New Guinea.

Habitat & Ecology — Primary and secondary submontane rain forest; altitude 1300–2250 m. Fl. July, Sep., Nov., Dec.; fr. Sep., Apr.

Field notes — Bark dark grey or brown, smooth

or slightly cracked; inner bark reddish brown, sapwood straw-coloured, heartwood red-brown.

**c. var. sumbawaense** (Kosterm.) Nielsen, Bull. Mus. Natn. Hist. Nat. Paris, sér. 4, 5, sect. B, Adansonia no 3 (1983) 328; *ibid.*, sér. 4, 6, sect. B, Adansonia no 1 (1984) 83. — *Abarema sumbawaensis* Kosterm., Reinwardtia 6 (1962) 160, f. 45.

Tree to 25 m high, stem 50 cm in diameter, slightly buttressed. Indumentum of inflorescence, young branches and leaf-rachis densely velutinous or hirsute. Petiolar glands sessile, leaflets densely velutinous or hirsute, apex rounded to acuminate, obtuse. Calyx 1.5–2 mm. Corolla 6–7 mm long.

Distribution — *Malesia*: Lesser Sunda Islands (Sumbawa, W Flores).

Habitat & Ecology — On ridges in semi-wet forest; on andesite; altitude 500–1500 m. Fl. Apr.–May.

Field notes — Bark brown, slightly cracked or smooth, living bark pale brown, sapwood white or dirty white, heartwood brown.

## PARASERIANTHES

*Paraserianthes* Nielsen in Nielsen, Guinet & Baretta-Kuipers, Bull. Mus. Natn. Hist. Nat. Paris, sér. 4, 5, sect. B, Adansonia no 3 & 4 (1983) 326, 350.

*Albizia* § 2 *Lophantha* Miq., Fl. Ind. Bat. 1 (1855) 29. — *Albizia* sect. *Lophantha* (Miq.) Fourn., Ann. Sc. Nat. Bot. sér. 4, 15 (1861) 172; Kanis, Brunonia 2 (1980) 291.

*Albizia* sect. *Lophantha* Miq. ser. *Pachyspermae* Benth., Trans. Linn. Soc. 30 (1875) 559.

— *Albizia* sect. *Pachyspermae* (Benth.) Fosb., Reinwardtia 7 (1965) 74, p. p.

'Gen. A' Nielsen in Polhill & Raven (eds.), Adv. Leg. Syst. 1 (1981) 184.

Unarmed shrubs or trees. Stipules linear or filiform, caducous, not spinescent. *Leaves* bipinnate, rachis and pinnae with extrafloral nectaries; leaflets opposite, sessile. *Inflorescences* composed of pedunculate spikes or racemes, the spikes sometimes aggregated into panicles axillary to the distal leaves. *Flowers* bisexual, pentamerous, uniform. Calyx connate, valvate, sometimes circumscissile at the base. Corolla connate, valvate. *Stamens* numerous, united into a tube at the base. Ovary solitary. *Pods* chartaceous, straight, flat, dehiscent, not segmented, not reddish inside, the endocarp not forming envelopes around each seed. *Seeds* suborbicular-elliptic or oblong, flat or convex, with a hard olive-green, brown or black testa, with pleurogram, wingless, aril absent, endosperm absent, cotyledons large. — **Fig. 24.**

Distribution — Australia (2 species), Melanesia (1 species), East and Central *Malesia* (3 species), 4 species in all.

Habitat & Ecology — Trees of montane forest and lowland rain forest.

Morphology & Taxonomy — The morphology of this genus is extensively reviewed by Nielsen, Guinet & Baretta-Kuipers (l.c.: 304). Important characters for the subdivision of the genus are the structure of the inflorescence and that of the pollen. The genus is closely allied to *Serianthes*, but has opposite leaflets and dehiscent pods.

#### KEY TO THE SPECIES

- 1a. Flowers aggregated into solitary or paired, axillary racemes (Sect. *Paraserianthes*)
  - 1. ***P. lophantha***
- b. Flowers aggregated into panicles (Sect. *Falcataria*) . . . . . 2
- 2a. Leaflets oblong to trapezoid, 8–25 mm broad, obtuse . . . . . 3. ***P. pullenii***
- b. Leaflets oblong-falcate, (2–)3.2–6 mm broad, sharply acute(-cuspidate)
  - 2. ***P. falcataria***

#### Section *Paraserianthes*

Flowers aggregated into solitary, axillary racemes. Pollen with costae, i.e. pores surrounded by distinct thickenings.

Distribution — Monotypic; SW Australia; *Malesia*: Sumatra, Java, Lesser Sunda Islands (Bali, Flores).

**1. *Paraserianthes lophantha*** (Willd.) Nielsen, Bull. Mus. Natn. Hist. Nat. Paris, sér. 4, 5, sect. B, *Adansonia* no 3 & 4 (1983) 326, 352. — *Acacia lophantha* Willd., Sp. Pl. ed. 4, 4 (1806) 1070. — *Mimosa lophantha* (Willd.) Pers., Syn. Pl. 2 (1807) 264. — *Albizia lophantha* (Willd.) Benth., Lond. J. Bot. 3 (1844) 86; Backer & Bakh. f., Fl. Java 1 (1963) 552; Steenis, Mountain Fl. Java (1972) pl. 26: 4; Bot. J. Linn. Soc. 79 (1979) 139, f. 23.

*Mimosa distachya* Vent., Descr. Pl. Nouv. Jard. J. M. Cels. 5 (1800) 20, non Cav. (1795). — *Albizia distachya* (Vent. non Cav.) Macbr., Contr. Gray Herb. 59 (1919) 3.

*Mimosa elegans* Andrews, Bot. Repos. 9 (1809) t. 563.

*Acacia insignis* Hoffsgg., Verz. Pflanzenkult. (1824) 159.

Distribution — Two subspecies are distinguished, subsp. *lophantha* from SW Australia and subsp. *montana* with 2 varieties, which are endemic to *Malesia*.

Note — For information about the variation see Nielsen, l.c.

subsp. ***montana*** (Jungh.) Nielsen, Bull. Mus. Natn. Hist. Nat. Paris, sér. 4, 5, sect. B, *Adansonia* no 3 & 4 (1983) 327, 354. — *Acacia montana* Jungh., Nat. Tijd. Ned. Ind. 5 (1842) 626; Nat. Geneesk. Arch. Ned. Ind. 2 (1845) 35. — *Inga montana* (Jungh.) Jungh., Topog. & Natuurw. Reisen (1845) 288, 305. — *Albizia montana* (Jungh.) Benth. in Miq., Pl. Jungh. 1 (1851) 267; Miq., Sumatra (1860) 105; Fosb., Reinwardtia 7 (1965) 77. — *Albizia lophantha* var. *montana* Hochr., Candollea 2 (1925) 373.

*Acacia vulcanica* Korth. ex Hassk., Flora 5 (1847) 705, nom. superfl.

*Albizia benthamiana* Blume ex Miq., Fl. Ind. Bat. 1 (1855) 30.

Distribution — *Malesia*: Sumatra, Java, Lesser Sunda Islands (Bali, Flores).

#### KEY TO THE VARIETIES

- 1a. Stipules subcordate, triangular or semi-ovate-lanceolate, 0.5–1.7 cm . . **a. var. *montana***
- b. Stipules triangular-ovate, 0.2–0.3 cm
  - b. var. *kostermansii***

**a. var. montana**

Shrub or tree to 10 m high, up to 30 cm in diameter. Bark of trunk smooth, grey-green, lenticellate. Branchlets terete but ridged by decurrent ridges from the leaf bases, with dense coarse rusty indumentum, tomentose, woolly, or flocculose, somewhat glabrescent but never quite so. Stipules subcordate, triangular or semi-ovate to lanceolate, slightly caudate, 0.5–1.7 cm, densely tomentose. *Leaves*: rachis 11–25 cm, densely rusty tomentose,  $\pm$  glabrescent; petiole 2.2–6 cm, with a gland (1–)1.6–4.5 cm above the base, circular to elliptic, usually raised, convex to concave, (1–)1.5–4 mm long and with a smaller gland at the junction of the distal pair of pinnae; pinnae (6–)9–13 pairs, opposite, tomentose, glandless, to 12 cm; leaflets (13–)15–34 pairs per pinna, sessile, chartaceous, oblong, (5–)6–11 by 1.5–3.5 mm, base very asymmetrically truncate/rounded, apex obtuse and mucronulate, or acute; both surfaces appressed puberulous to sericeous before unfolding, often subglabrescent with scattered hairs on the lower surface, main vein not parallel to the front margin, 1–3 accessory veins ascending from the base. *Inflorescences* composed of pedunculate solitary or paired spikes in the distal leaf-axils; spikes 5.2–11(–18) cm (incl. peduncle), densely tomentose or woolly, pedicels to 1 mm, bracts ovate to lanceolate-linear, acuminate, 3.5–7 mm, concave, densely sericeous, caducous. *Flowers*: calyx green, cup-shaped, 1.5–3 mm,  $\pm$  appressed puberulous; teeth  $\pm$  unequal, triangular acute, (0.3–)0.5–1.5 mm. Corolla green, funnel-shaped, 4.5–6(–8) mm, densely appressed puberulous; lobes ovate to oblong, acute, 1.5–2(–3.9) mm. *Stamens* yellowish green or pale yellow, 10–15 mm, tube 2.5–4 mm, equalling or slightly exceeding the corolla-tube. Ovary 2 mm, sessile, glabrous, style exerted beyond the stamens. *Pod* unwinged, red-brown, thinly chartaceous, oblong, stalked, apicu-

late at the apex, 5.5–9.5(–11) by 1.4–2.6 cm, margins only slightly thickened, valves with prominent, reticulate transverse veins, dehiscent along both sutures, swollen over the seeds. *Seeds* black, (narrowly) elliptic, compressed, 5.5–7 by 3.5–4.5 by 2 mm; areole elliptic, 4.5 by 2.5–3 mm, pleurogram parallel to the margin, usually open towards the hilum.

*Distribution* – *Malesia*: Sumatra, Java, Lesser Sunda Islands (Bali).

*Habitat & Ecology* – Light montane forest, elfin forest, grassy plains, often on crater-slopes and on stony, open places; shade-intolerant; altitude (600–)1500–3265 m. Fl., fr. throughout the year.

*Uses* – The species is cultivated and used for reforestation.

*Note* – According to Van Steenis [Natuurwet. Tijd. Ned. Ind. 101 (1941) 30] the trees fruit at a young age, 5–6 years, but then gradually decay because of infection by the rust fungus *Uromycladium tepperianum*. The seeds, which have a hard thick seed-coat, germinate after the influence of fire or acids from the solfataras. This results in single-dominant groves after the fire. The stems are bending towards the sun.

**b. var. kostermansii** (Fosb.) Nielsen, Bull. Mus. Natn. Hist. Nat. Paris, sér. 4, 5, sect. B, Adansonia no 3 & 4 (1983) 327, 355. — *Albizia montana* (Jungh.) Benth. var. *kostermansii* Fosb., Reinwardtia 7 (1965) 79.

Differs from var. *montana* in the following aspects: Stipules triangular ovate, 2–3 mm. Calyx 1.5 mm. Corolla 4–4.5 mm.

*Distribution* – *Malesia*: Lesser Sunda Islands (Flores: Keli Mutu & Golo Ponto).

*Habitat & Ecology* – Montane forest; altitude 1400–1800 m.

## Section *Falcataria*

*Paraserianthes* sect. *Falcataria* Nielsen in Nielsen, Guinet & Baretta-Kuipers, Bull. Mus. Natn. Hist. Nat. Paris, sér. 4, 5, sect. B, Adansonia no 3 & 4 (1983) 327, 356.

Flowers in panicle racemes or spikes. Pollen without costae.

*Distribution* — This section comprises 3 species: *P. toona*, endemic to Australia, and two species in *E Malesia* and Solomon Islands.



**2. *Paraserianthes falcataria* (L.) Nielsen,**

Bull. Mus. Natn. Hist. Nat. Paris, sér. 4, 5, sect. B, Adansonia no 3 & 4 (1983) 327, 357, pl. 9, 10. — *Adenantha falcataria* L., Sp. Pl. ed. 2 (1762) 550. — *Albizia falcataria* (L.) Fosb., Reinwardtia 7 (1965) 88; Cockb., Trees Sabah 1 (1976) 187, f. 41, pl. 12; Verdc., Manual New Guin. Legum. (1979) 182; Kosterm., Ceyl. J. Sci. (Biol. Sci.) 13 (1979) 256; Rev. Handb. Fl. Ceyl. 1 (1980) 530.

*Clypearia alba* Rumph., Herb. Amb. 3 (1743) 176, t. 111.

*Albizia moluccana* Miq., Fl. Ind. Bat. 1 (1855) 26.

*Albizia falcata* auct. non (L.) Backer: Backer, Voorl. Schoolfl. Java (1908) 109; Schoolfl. Java (1911) 437; Backer & Bakh. f., Fl. Java 1 (1963) 553; Whitm., Guide For. Brit. Solom. Isl. For. Rec. 2 (1966) 81; Whitm., Tree Fl. Malaya 1 (1972) 277, f. 2, 13.

Distribution — Solomon Islands; in *Malesia*: Moluccas, New Guinea, Bismarck Archipelago. Widely cultivated. — Fig. 23.

**KEY TO THE SUBSPECIES**

- 1a. Leaf-rachis woolly, flocculose; petiolar gland 1–2 mm, hardly raised. Pods very densely puberulous or tomentose, not or very tardily glabrescent . . . . . **b. subsp. *fulva***
- b. Leaf-rachis puberulous or densely tomentose; petiolar gland 2–7(–9) mm long, raised. Pods puberulous, glabrescent . . . . . 2
- 2a. Main vein of leaflets distant by  $1/3$ – $1/4$  of the width of the leaflet from the front margin; lateral veins prominulous beneath . . . . . **c. subsp. *solomonensis***
- b. Main vein of leaflet distant by c.  $1/5$  of the width of the leaflet from the front margin, lateral veins inconspicuous to prominulous beneath . . . . . **a. subsp. *falcataria***

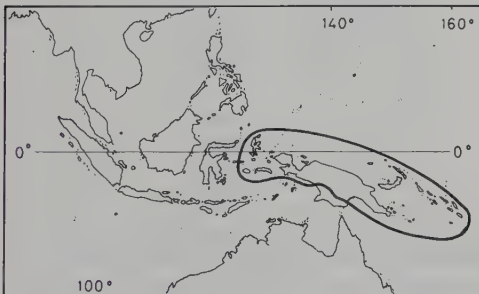


Fig. 23. Distribution of *Paraserianthes falcataria* (L.) Nielsen.

**a. subsp. *falcataria***

Tree to 40(–52) m high, d.b.h. 20–100 cm; bole up to 20 m, with or without buttresses; young parts of branches, inflorescence, leaf-rachis and pinnae puberulous to tomentose. Branchlets angular by decurrent ridges from the leaf-scars. Stipules caducous, linear-filiform, c. 3–5 by 0.5–1 mm. *Leaves*: rachis (12–)20–43 cm, sulcate, petiole 2–8 cm, with a gland in the distal half of the petiole, raised, circular-obtriangular or elliptic (oblong) in outline, (2.9–)3–7(–9) mm, often widened in the distal part; pinnae 8–24 pairs, (1.5–)6.5–13(–16.5) cm, with small glands at the junctions of the distal pairs of leaflets; leaflets (4–)8–27(–33) pairs per pinna, sessile, chartaceous, oblong, sometimes  $\pm$  falcate, 6–15 by (2–)2.5–6 mm, base asymmetrical, half truncate/half cuneate, apex obtuse to sharply acute, sometimes cuspidate, often bent forwards; both surfaces densely appressed puberulous, the main vein strongly so; main vein parallel to and distant by c.  $1/5$  of the width of the leaflet from the front margin, 2 or 3 prominulous accessory veins at the base, lateral veins inconspicuous to prominulous beneath. *Inflorescences* composed of pedunculate spikes, aggregated into axillary panicles at the distal leaf-axils, to 30 by 25 cm, ultimate spikes to 3.5 cm (incl. peduncle), with flowers approximately in the distal half. *Flowers* sessile, pentamerous, subtended by early caducous, concave bracts. Calyx green, cup-shaped, 1.5–2.7(–3) mm, puberulous; teeth deltoid, acute, 0.3–1 mm. Corolla cream or greenish yellow, funnel-shaped, (4–)5–6.5 mm, sericeous; lobes ovate-oblong, acute, reflexed when old, (1.5–)2.5–3(–3.5) mm. *Stamens* white, c. 10–15 mm, tube 3.5 mm, equal to or longer than corolla-tube. Ovary glabrous, 1.5–2 mm, shortly stipitate, often with a ring-shaped nectary at the base. *Pod* yellowish red-brown (when dry), chartaceous, oblong, 7.5–10.5 by (1.3–)1.5–1.7 cm, puberulous, glabrescent, with an up to 3 mm broad wing along the ventral suture, valves with transverse reticulate prominulous veins, swollen over the seeds, dehiscent along both sutures. *Seeds* olive-green, oblong, flat, 6–7.5 by 3–4 mm; areole oblong 4–5.5 by 1–1.2 mm, open towards the hilum. — Fig. 24.

Distribution — *Malesia*: Moluccas, New Guinea. Widely cultivated.

Habitat & Ecology — Primary and especially secondary rain forest, often on river flood terraces, and in regrowth; sandy soils; altitude 0–1600 m. Fl., fr. throughout the year.

Field notes — Fast growing tree, rarely with

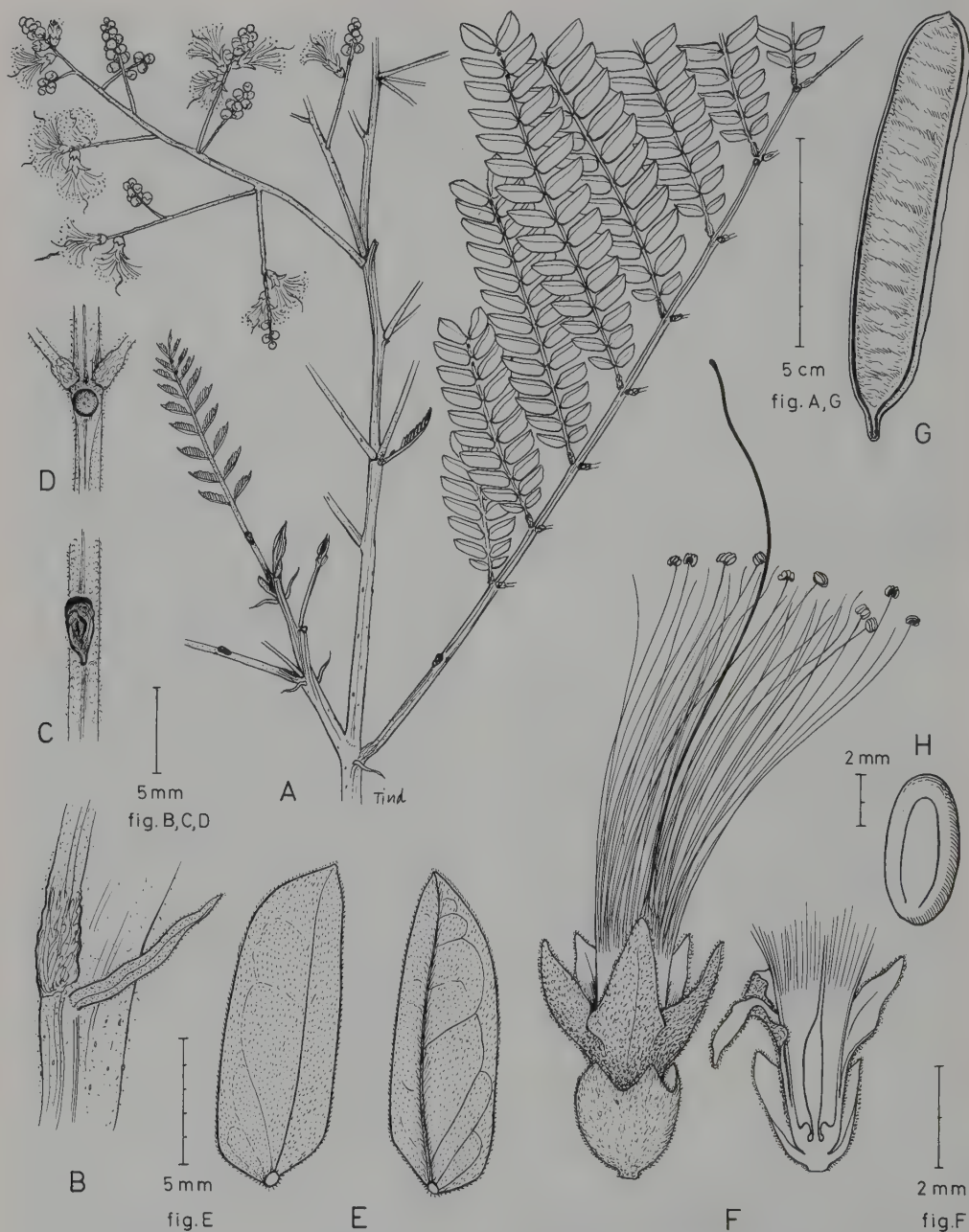


Fig. 24. *Paraserianthes falcataria* (L.) Nielsen subsp. *falcataria*. A. Flowering branch; B. stipule; C. nectary on petiole; D. nectary on rachis; E. leaflets seen from above (left) and from below (right); F. flower; G. pod; H. seed (A–F: Sinclair s.n., Apr. 1951; G, H: Meijer 7198).

quite straight bole. Bark white, light grey, grey or greenish, smooth or slightly warty, sometimes with longitudinal rows of brown lenticels; under-bark reddish brown, inner bark white, straw or pink; sapwood white, soft, heartwood light red or yellow-brown often indistinct, soft.

Uses – This subspecies is often used in reforestation as it grows extremely quick. It is reputed to be one of the fastest growing trees in the world [cf. Trop. Legum., Res. Future, Nat. Acad. Sci. Washington D.C. (1979) 173–177]: after 10 year it may reach a height of c. 40 m. Used as a shade-tree in cocoa and coffee plantations, but as the trees in everwet areas may rot away after 8–10 years (pers. obs.), it cannot be recommended, neither for the crops mentioned nor for minor agricultural ones, as the roots are superficial. The wood is soft, used as a substitute for pine. The bark can be stripped off and used for packing purposes; it is also used in canoe-building. In Java cultivated up to 1600 m. The species needs more than 2,000 mm rain per year, with at least 15 rainy days during the driest four months.

**b. subsp. *fulva*** (Lane-Poole) Nielsen, Bull. Mus. Natn. Hist. Nat. Paris, sér. 4, 5, sect. B, Adansonia no 3 & 4 (1983) 327, 359. — *Albizia fulva* Lane-Poole, Rep. For. Res. Papua New Guinea (1925) 91; White & Francis, Proc. Roy. Soc. Qld. 38 (1927) 250; Fosb., Reinwardtia 7 (1965) 86; Verdc., Manual New Guin. Legum. (1979) 184.

*Albizia eymae* Fosb., Reinwardtia 7 (1965) 87.

Young parts of branches, inflorescence, leaf-rachis and pinnae densely tomentose to woolly. Petiolar gland hardly or not raised, circular in outline, 1–2 mm in diameter; leaflets 4–6 by 3.2–4.5 mm, main vein distant by c. 1/3 of the width of the leaflet from the front margin; lateral veins inconspicuous to prominulous beneath; both surfaces densely puberulous or sericeous, margins and main vein ciliate-setose. Calyx 2.8–3.5(–4.5) mm. Corolla 6.5–9 mm. Pod 9.5–12(–14) by (1.4–)1.7–2.8 cm, wing 3 mm wide, densely puberulous to tomentose, glandular, dark brown, not or very tardily glabrescent.

Distribution – *Malesia*: endemic to the central montane part of New Guinea.

Habitat & Ecology – Primary and secondary montane rain forest and regrowth on peat soil, but the subspecies is also recorded from well-drained soil; *Dacrydium* forest, *Nothofagus* forest; altitude 1250–2300 m.

Note – This subspecies attains dimensions similar to those of subsp. *falcataria*; it is a tall tree up to 52 m, bole to 22 m, d.b.h. to 100 cm. The branches tend to be stronger angled than in subsp. *solomonensis* and the tree has a flat-topped crown.

Uses – The bark is used for fibre and as a substitute for soap.

**c. subsp. *solomonensis*** Nielsen, Bull. Mus. Natn. Hist. Nat. Paris, sér. 4, 5, sect. B, Adansonia no 3 & 4 (1983) 327, 359.

Young parts of branches, inflorescence, leaf-rachis and pinnae puberulous to tomentose. Petiolar gland raised, obtriangular in outline, 3–6 mm; leaflets (7–)8.5–17 by (2.5–)4.5–6 mm; main vein distant by 1/4–1/3 of the width of the leaflet from the front margin; lateral vein prominulous to prominent beneath; main vein and margins setose. Calyx 1.5–2 mm. Corolla 4.5–5.5 mm. Pod 8.2–12 by 1.7–2.5 cm, yellowish, puberulous, glabrescent, wing 4 mm wide.

Distribution – Solomon Islands; in *Malesia*: Bismarck Archipelago and a few off-shore islands N of Papua New Guinea, Admiralty Islands.

Habitat & Ecology – Lowland and hills, primary and secondary forest, ridge forest; once recorded from brown loam soil; altitude 0–600 m.

Uses – Bark used for packing purposes.

**3. *Paraserianthes pullenii*** (Verdc.) Nielsen, Bull. Mus. Natn. Hist. Nat. Paris, sér. 4, 5, sect. B, Adansonia no 3 & 4 (1983) 327, 356, pl. 9. — *Albizia pullenii* Verdc., Kew Bull. 33 (1979) 408; Manual New Guin. Legum. (1979) 188.

Tree to 31 m high, bole unbuttressed, up to 55 cm in diameter; branchlets velvety brown pubescent, glabrescent. Stipules not seen. *Leaves*: rachis to 8 cm, densely puberulous, sulcate; petiole 1.5–4 cm, with glands at the junctions of the pinnae, circular, sessile, with raised margins, 1.5–2 mm; pinnae 2 or 3 pairs, puberulous, 8–13.5 cm, with glands at the junctions of the 3 or 4 distal pairs of leaflets, circular, concave, sessile, c. 1 mm in diameter; leaflets 5–7 pairs per pinna, thickly chartaceous, petiolule 1 mm, blade oblong to trapezoid, 20–60 by 8–25 mm, base asymmetrically cuneate, apex obtuse, sometimes ± emarginate; both surfaces sparsely puberulous, glabrescent except for the main vein; main vein diagonal to subcentral, lateral veins prominulous, reticulate. *Inflorescence* composed of short spikes 0.8–4.5



cm, aggregated into an axillary or terminal rusty tomentose panicle to 10 cm; flowers sessile, subtended by 1.5–2 mm long, ovate, concave, densely tomentose bracts. Calyx cup-shaped or campanulate, 2.5–3.5 mm, tomentose; teeth triangular, acute, 0.5–1 mm. Corolla yellow-brown, funnel-shaped, 5–6.8 mm, tomentose or appressed puberulous; lobes ovate or elliptic, acute, 3–3.5 mm. *Stamens* cream, 10 mm, tube 3–3.5 mm, equalling the corolla-tube. Ovary sessile, c. 1.5–2 mm, glabrous, style 3.5 mm, shorter than the stamens. Pods and seeds unknown.

Distribution – *Malesia*: Papua New Guinea (Central Prov.).

Habitat & Ecology – Hilly rain forest on shallow stony soil or on gravelly sandy clay; altitude 66–120 m. Fl. June.

Field notes – Bark of trunk patchy brown and grey; sapwood pale amber, heartwood dark yellow-brown.

Note – By the shape of the inflorescence and the leaf characters this species seems to be allied to *P. falcataria*.

## PITHECELLOBIUM

*Pithecellobium* Mart., Flora 20, 2, Beibl. 8 (1837) 4, nom. cons.; Benth., Lond. J. Bot. 3 (1844) 195; Benth. & Hook. f., Gen. Pl. 1, 2 (1865) 597; Benth., Trans. Linn. Soc. 30 (1875) 570; Taub. in E. & P., Nat. Pflanzenfam. 3, 3 (1891) 104; Kosterm., Bull. Organ. Natuurw. Onderz. Indon. 20 (1954) 7; Mohlenbr., Reinwardtia 6 (1963) 438, p.p.; Hutch., Gen. Fl. Pl. 1 (1964) 296, p.p.; Nielsen in Polhill & Raven (eds.), Adv. Leg. Syst. 1 (1981) 184.

Trees or shrubs armed by spinescent stipules and stipella. *Leaves* bipinnate, not sensitive to the touch; rachis and pinnae usually with extrafloral nectaries. *Inflorescences* composed of pedunculate glomerules or corymbs which are aggregated into terminal or axillary panicles. *Flowers* uniform, bisexual, pentamerous. Calyx connate, valvate. Corolla connate, valvate. *Stamens* numerous, united in a tube at the base. Ovary solitary. *Pods* straight or spirally contorted, flat, dehiscing along both sutures, in most species dark brown outside, reddish orange within. Funicle in most species developed into an aril, covering the proximal part of the seed. *Seeds* brown or blackish, wingless, obovate or asymmetric, with areole.

Distribution — A genus of c. 20 species, indigenous in tropical and subtropical America. Three Asian species, *P. nitidum* (Sri Lanka), *P. tenue* (Thailand), and *P. vietnamense* (S Vietnam), are provisionally referred to this genus, but they lack the aril, and may belong to the genus *Havardia* (cf. Nielsen, l.c.); two species are introduced to *Malesia*, one an old introduction and common, and one newly established.

Habitat & Ecology — Areas with a (sub)tropical seasonal climate in regions of America.

Taxonomy — Formerly, the major part of the species now referred to *Archidendron* and some of the species of *Albizia* were referred to this genus. If these discordant elements would be united into one genus, this would be the only genus of the, bipinnate, tribus *Ingeae*, and *Pithecellobium* would not be the oldest name, both *Zygia* and *Albizia* being older. For taxonomic reasons [Nielsen, l.c. and Nielsen, Baretta-Kuipers & Guinet, Opera Bot. 76 (1984) 8] *Pithecellobium* is restricted to comprise the New World species, characterized by spinescent stipules, uniform flowers and funicular aril.

## KEY TO THE SPECIES

- 1a. Corolla tomentose. Stamens 8–10 mm. Ovary puberulous. Glomerules 15–25-flowered . . . . . ***P. dulce***  
 b. Corolla glabrous to sparsely puberulous. Stamens 12–18 mm. Ovary glabrous. Glomerules 7–15-flowered. Tropical America. Planted, a more recent introduction  
*P. unguis-cati* (L.) Benth.

***Pithecellobium dulce*** (Roxb.) Benth., Lond. J. Bot. 3 (1844) 213; Kosterm., Bull. Organ. Natuurw. Onderz. Indon. 20 (1954) 8; Backer & Bakh. f., Fl. Java 1 (1963) 551; Whitm., Tree Fl. Malaya 1 (1972) 285; Cockb., Trees Sabah 1 (1976) 196; Verdc., Manual New Guin. Legum. (1979) 209; Nielsen, Fl. Camb. Laos Vietnam 19 (1981) 108, pl. 19: 14–18. — *Mimosa dulcis* Roxb., Pl. Corom. 1 (1798) 67, t. 99; Fl. Ind. ed. 2, 2 (1832) 556. — *Inga dulcis* (Roxb.) Willd., Sp. Pl. ed. 4, 4 (1806) 1005.

Shrub or tree to 15 m high, to 45 cm in diameter. Branchlets rounded, brownish, sparsely puberulous, glabrescent, armed with spinescent stipules to 1.2 cm. *Leaves*: petiole 0.3–5 cm, with one gland at the junction of the pinnae, circular, substipitate, with raised margins, 0.25 mm in diameter; pinnae 1 pair, 0.2–1 cm, with a gland at the junction of the leaflets, stipella 1–2 mm, at the junction of the leaflets; leaflets sessile, 1 pair per pinna, chartaceous, asymmetrically elliptic to obovate-elliptic, 0.7–5, by 0.3–2.3 cm, base asymmetrically obtuse, apex obtuse-emarginate, both surfaces glabrous; lateral veins reticulate, hardly visible above, raised beneath. *Inflorescence* composed of pedunculate glomerules aggregated into terminal densely puberulous panicles or racemes; peduncles 0.5–0.6 cm, bearing a glomerule of 15–20 flowers. Calyx green, cup-shaped, tomentose, 1–1.5 mm; teeth triangular, 0.3–0.4 mm. Corolla green, funnel-shaped, tomentose, c. 3–4.5 mm; lobes ovate, acute, 1 mm. *Stamens* white, to c. 9 mm, tube equalling the corolla-tube. Ovary puberulous, 2–3 mm, stipitate. *Pods* dark

brown outside, reddish to pinkish within, slightly flattened, glabrous or slightly puberulous, 10–12.5 (–15) by 1–1.6 cm, dehiscent along both sutures, swollen over the seeds. *Seeds* black, glossy, obovate-oblong, often asymmetric in outline, flattened, 9–12 by 7–8 by 1–2 mm, funicle gradually thickened into a fleshy white or pink aril, covering the proximal part of the seed; areole to 7.5 by 3 mm.

*Distribution* – Native of Central America (Mexico), now cultivated and naturalized in most of the tropics, especially in areas with a seasonal climate.

*Habitat & Ecology* – Waste land, hedges, brushwood; altitude 0–500 m. Fl., fr. Mar.–Nov.

*Uses* – Bark used for tanning. The sweet aril is edible and used in lemonades. Timber soft but heavy, used for general construction as posts, and as fuel. Used for hedges after pruning. Cattle and goats feed on the fallen fruits.

*Note* – Introduced into the Philippines from Mexico, later introduced to India, where it was first described by Roxburgh. For further notes see Kostermans (l.c.: 10).

## DUBIOUS

*Pithecellobium ? platycarpum* Merr., Philipp. J. Sc., Bot. 5 (1910) 17; Nielsen, Opera Bot. 76 (1984) 106. — *Paralbizzia platycarpa* (Merr.) Kosterm., Bull. Organ. Natuurw. Onderz. Indon. 20 (1954) 23.

Topotypic material needed from Twin Peaks, Province of Benguet, Luzon before the identity of this taxon can be known.

## SAMANEA

*Samanea* Merr., J. Wash. Acad. Sc. 6 (1916) 47; Hutch., Gen. Fl. Pl. 1 (1964) 294.

Unarmed tree. Stipules not spinescent. *Leaves* bipinnate, not sensitive to the touch, rachis and pinnae with extrafloral nectaries; leaflets opposite. *Inflorescences* composed

of pedunculate, axillary corymbs; floral bracts small. *Flowers* dimorphic, central flowers enlarged, 7- or 8-merous, marginal flowers smaller, 5-merous. Calyx connate, valvate. Corolla connate, valvate. *Stamens* many, united into a tube toward the base, anthers eglandular. Ovary solitary. *Pod* oblong, straight or slightly curved, turgid with thickened margins, indehiscent, woody; exocarp crustaceous, separating from the pulpy mesocarp, endocarp woody, forming one-seeded chambers. *Seeds* elliptic in outline, strongly biconvex, with pleurogram, wingless; aril and endosperm absent; cotyledons large, radicle curved.

**Distribution** — Northern tropical South America, one species introduced and widely cultivated in all tropical areas.

**Note** — Hutchinson (l.c.) referred 18 species to this genus. Probably all these species have to be referred to *Albizia*, but the formal transfers should be done only in connection with a revision of the American species.

**Samanea saman** (Jacq.) Merr., J. Wash. Acad. Sc. 6 (1916) 47; Enum. Philipp. 2 (1923) 242; Backer & Bakh. f., Fl. Java 1 (1963) 550; Verdc., Manual New Guin. Legum. (1979) 207; Nielsen, Fl. Camb. Laos Vietnam 19 (1981) 106, pl. 19: 9–13; Fl. Thailand 4, 2 (1986) 202, f. 51. — *Mimosa saman* Jacq., Fragm. Bot. (1800/09) 15, t. 9. — *Inga saman* (Jacq.) Willd., Sp. Pl. 4 (1806) 1024. — *Pithecellobium saman* (Jacq.) Benth., Lond. J. Bot. 3 (1844) 216; Trans. Linn. Soc. 30 (1875) 587. — *Albizia saman* (Jacq.) F. Muell., Select. Extra-Trop. Plants (1891) 27. — *Enterolobium saman* (Jacq.) Prain, J. As. Soc. Beng. 66, 2 (1897) 252.

Tree to 25 m, with a large crown spreading to 33 m in a complete canopy, d.b.h. to at least 100 cm. Branchlets puberulous to tomentose. *Leaves*: rachis to 40 cm, with gland(s) just below the junction of the basal pair of pinnae and distally at all other pairs of pinnae, circular, concave, sessile, c. 0.5 mm in diameter; pinnae 3–9 pairs, to 11 cm, with glands at the junctions of the leaflets; leaflets 2–10 pairs per pinna, asymmetrically, ovate, elliptic or subrhomboid, base half rounded/half truncate, apex rounded or obtuse, often emarginate and mucronulate; main vein diagonal, lateral veins densely reticulate, raised, upper surface glabrous, lower surface densely short-pubescent. *Inflorescence*: peduncles densely shortly yellowish pubescent, 2–5 together in the distal leaf-axils, 5–10 cm long, bearing a terminal corymb. *Marginal flowers* c. 3 cm, pedicellate; calyx funnel-shaped, 5–7 mm, tomentose or woolly; teeth broadly triangular, acute, 0.5–1 mm; corolla red or

yellowish-red, funnel-shaped, c. 10–12 mm, distal part tomentose or woolly; lobes triangular-ovate, c. 2 mm; stamens white at base, purple toward the top, 20–35 cm, tube shorter than the corolla-tube; ovary sessile, glabrous. *Central flower* sessile; corolla to 12 mm; staminal tube longer than the corolla. *Pod* black, oblong, 15–20 by 1.5–2.3 cm, inside transversely septate. *Seeds* brown, elliptic, strongly biconvex, c. 8 by 5 by 4 mm; areole elliptic, c. 7 by 3 mm.

**Distribution** — Native of northern tropical South America, now planted and appearing spontaneous all over the tropics; planted throughout *Malesia*.

**Habitat & Ecology** — Sandy, coastal areas; along roadsides, often planted; altitude 0–1800 m. Fl., fr. Aug.–Apr.

**Field notes** — Bark finely closely fissured, light grey or greyish brown. The sapwood is whitish, the heartwood dark chocolate-brown.

**Uses** — The 'Rain Tree' is widely cultivated as an ornamental and together with the 'Flamboyant' (*Delonix regia* Raf.) belongs to the most common street trees; both are characterized by a broad umbrella-shaped crown. A good honey plant. Pods used as fodder for cattle, pigs and goats. The wood is used for furniture, general construction, boxes, crates etc., but is not durable.

**Note** — During the night, and when the sky is overcast during the day, the leaves are hanging loosely down as in most other Mimosoids, hence its popular name Rain Tree. Another explanation for the name is the excretion of sugar-rich juice by extrafloral nectaries, which drops from the trees like rain.



# SERIANTHES

*Serianthes* Benth., Lond. J. Bot. 3 (1844) 225; *ibid.* 5 (1846) 108; Trans. Linn. Soc. 30 (1875) 599; Fosb., Reinwardtia 5 (1960) 293; Kanis, Brunonia 2 (1980) 289; Nielsen, Guinet & Baretta-Kuipers, Bull. Mus. Natn. Hist. Nat. Paris, sér. 4, 6, sect. B, Adansonia no 1 (1984) 84. — *Albizia* sect. *Serianthes* (Benth.) F. Muell., Fragm. 8 (1874) 165.

Unarmed trees or shrubs. Stipules linear or filiform, only visible in seedlings. *Leaves* bipinnate, rachis and pinnae usually with extrafloral nectaries; leaflets except for the distal pair(s) alternate, sessile. *Inflorescences* composed of pedunculate spikes, racemes or 1–4-flowered glomerules aggregated into racemes, panicles or umbels; floral bracts large, concave, tomentose. *Flowers* bisexual, pentamerous, uniform. Calyx connate, valvate, usually circumscissile at the base. Corolla connate, valvate, tube united with the staminal tube in the lower part. *Stamens* numerous, united into a tube at the base. Ovary(ies) 1 (or 2), sessile. *Pods* woody, straight or curved, flat, indehiscent or tardily dehiscent; usually the transverse seeds each isolated in a chamber; valves brownish to blackish outside, not reddish inside; endocarp not forming envelopes around each seed. *Seeds* usually elliptic or oblong, flattened, with a hard black testa with pleurogram, wingless; aril absent; endosperm absent; cotyledons large, radicle curved. — **Fig. 25.**

**Distribution** — Continental SE Asia (Thailand); throughout Malesia, Micronesia, Melanesia and W Polynesia; c. 18 species in all of which 4 in *Malesia*.

**Habitat & Ecology** — Trees in rain forest at low altitude, up to 800 m; *S. grandiflora* littoral in beach forest, *S. hooglandii* sometimes in open savanna country. The seed of *S. grandiflora* obviously is dispersed by sea-water.

**Morphology & Taxonomy** — Extensively reviewed by Nielsen et al. (l.c.). Important characters for the subdivision of the genus are the structure of the inflorescence and that of the pods, as used in the key. The genus is closely allied to *Paraserianthes* (in Central & East Malesia and Australia), the essential difference being the alternate leaflets in *Serianthes*.

## KEY TO THE SPECIES

- 1a. Inflorescence composed of racemosely arranged, pedunculate spikes, aggregated into umbels and these in panicles. Calyx up to 5 mm long. Pods with a thinly woody epicarp and a parchmentlike endocarp (Subg. *Minahassae*) . . . . . **1. *S. minahassae***
- b. Inflorescence composed of racemosely or  $\pm$  corymbiform arranged pedunculate racemes. Calyx 7 mm long or more. Pods with a thin and flaking epicarp and a woody endocarp (Subg. *Serianthes*) . . . . . **2**
- 2a. Calyx and corolla with yellowish brown indument. Corolla-tube usually not projecting beyond the calyx. Pod swollen over the seeds; valves with hardly branched main veins. Main vein of leaflets strongly diagonal for more than the central third of the leaflet . . . . . **2. *S. grandiflora***

- b. Calyx with rusty brown indument, darker than the corolla. Corolla-tube projecting beyond the calyx. Pod not swollen over the seeds; valves with branched main vein. Main vein of leaflets diagonal across about the central third of the leaflet . . . . . 3
- 3a. Pinnae c. 20 pairs per leaf; leaflets (10-)12-15(-16) mm long. Corolla 27-36 mm long. Pod 6-6.5 cm wide . . . . . 4. *S. robinsonii*
- b. Pinnae 6-10(-11) pairs per leaf; leaflets (7-)9-17(-23) mm long. Corolla 24-29 mm long. Pod 4.5-6 cm wide . . . . . 3. *S. hooglandii*

### Subgenus *Minahassae*

*Serianthes* Benth. subg. *Minahassae* Nielsen in Nielsen, Guinet & Baretta-Kuipers, Bull. Mus. Natn. Hist. Nat. Paris, sér. 4, 5, sect. B, Adansonia no 3 (1983) 328; *ibid.*, sér. 4, 6, sect. B, Adansonia no 1 (1984) 91.

Inflorescence a panicle composed of pedunculate spikes. Stamens white or cream. Pod with a thinly woody epicarp and a parchment-like endocarp, hardly segmented within, tardily dehiscent to indehiscent.

Distribution — Monotypic; *Malesia*: Lesser Sunda Islands (Sumbawa), Celebes, Moluccas (Ceram, Talaud Is.), New Guinea (incl. Bismarck Archipelago) to the Solomon Islands.

1. *Serianthes minahassae* (Koord.) Merr. & Perry, J. Arnold Arbor. 23 (1942) 393; Verdc., Manual New Guin. Legum. (1979) 198; Kanis, Brunonia 2 (1980) 297, f. 1; Nielsen, Bull. Mus. Natn. Hist. Nat. Paris, sér. 4, 6, sect. B, Adansonia no 1 (1984) 91. — *Albizia minahassae* Koord., Meded. Lands Pl. Tuin 19 (1898) 416; Suppl. Fl. Celebes (1918) 13, t. 4; Kosterm., Bull. Org. Natuurw. Onderz. Indon. 20 (1954) 4; Fosberg, Reinwardtia 7 (1965) 81.

*Serianthes ledermannii* Harms, Bot. Jahrb. 55 (1918) 43. — *Serianthes minahassae* (Koord.) Merr. & Perry var. *ledermannii* (Harms) Fosb., Reinwardtia 7 (1965) 81.

*Albizia melanesica* Fosb., Reinwardtia 7 (1965) 85.

Tree up to 45 m high, bole up to 15(-20) m, 100(-125) cm in diameter; buttresses usually small or absent, occasionally up to 1 m high, 2 m wide. Rachis of leaves, pinnae and inflorescence brownish tomentellous,  $\pm$  glabrescent. *Leaves*: rachis (10-) 12-20(-25) cm, petiole (3-)4-9(-10) cm, with a gland in the lower half of the petiole; pinnae (10-)12-16(-22) pairs, subopposite, with gland(s) at the junctions of the 1-5 distal pairs of leaflets;

leaflets (12-)18-25(-32) pairs per pinna, alternate, chartaceous, oblong (4-)5-9 by (1.5-)2-4 mm, apex obtuse,  $\pm$  mucronulate, base obliquely truncate, main vein subdiagonal; upper surface subglabrous, lower surface densely puberulous,  $\pm$  glabrescent. *Inflorescence* composed of (1-)2-4 (-5) pedunculate spikes, arranged in lateral racemes; pedicels indistinct, less than 1 mm long. *Flowers*: calyx broadly campanulate, often  $\pm$  bilabiate, 3.5-4 (-5) mm long, teeth 1.7-3 mm long, unequal. Corolla funnel-shaped, (6-)7-8 mm long, densely ferruginous sericeous outside, white inside, lobes triangular-ovate, 4-5 mm long. *Stamens* white, 12-20(-25) mm long, tube c. 2 mm long. *Ovary* c. 1 mm long, sessile, glabrous. *Pod* brown or blackish,  $\pm$  oblong, sometimes slightly narrowed between the seeds, 9.5-18.5(-25) by (2-)2.5-4 (-7) cm, with thickened margins; valves with anastomosing veins, tardily dehiscent or indehiscent. *Seeds* ellipsoid, 13-26 by 3-9 by c. 1-2 mm, with an open areole.

Distribution — *Malesia*: Lesser Sunda Islands (Sumbawa), Celebes, Moluccas (Ceram, Talaud Is.), New Guinea (incl. Bismarck Arch.) to the Solomon Islands. Three allopatric subspecies are distinguished.

## KEY TO THE SUBSPECIES

- 1a. Pod (4.5–)5–7 cm wide **b. subsp. fosbergii**  
 b. Pod 2.7–4(–4.5) cm wide. . . . . 2  
 2a. Petiolar gland not concave in the central part.  
 Leaflets (2–)2.5–4 mm wide. Pods tardily de-  
 hiscent. . . . . **a. subsp. minahassae**  
 b. Petiolar gland with concave central part, often  
 rimmed. Leaflets 1.5–2.5 mm wide. Pods in-  
 dehiscent. . . . . **c. subsp. ledermannii**

**a. subsp. minahassae**

Petiolar gland 3–4.5 mm long, elliptic, raised, sometimes cushion-shaped, never concave. Leaflets (2–)2.5–4 mm wide, main vein at a distance of 1/3 to 2/5 of the width of the leaflet from the front margin. Pod 11–21 by 2.8–4(–4.5) cm, tardily dehiscent. Seeds 13–18 by 3–10 mm.

Distribution — *Malesia*: Lesser Sunda Islands (Sumbawa, cf. Kanis, l.c.: f. 1), Celebes, Moluccas (Talaud Is.).

Habitat & Ecology — In  $\pm$  moist primary rain forest, on level or steeply sloping terrain, soil peaty, clayey, or rocky, sometimes of volcanic origin; altitude 10–700(–800) m.

Note — The pod in *Kostermans* 1952 from Sumbawa is 4.5 cm wide, which is more than usual for this subspecies. The leaflets are 2–2.5 mm wide with the main vein at a distance of 1/3 of the width of the leaflet from the front margin. When flowering material comes to hand, the Sumbawa plants may prove to represent a distinct subspecies or variety.

- b. subsp. fosbergii** Kanis, *Brunonia* 2 (1980) 302. *Albizia melanesica* Fosb., *Reinwardtia* 7 (1965) 85; Foreman, *Bot. Bull. Papua New Guinea* 5 (1971) 45.

Petiolar gland 2–4(–5) mm long, elliptic, raised, concave, rimmed, sometimes with a saddle-like depression in the central part. Leaflets 5.5–9 by (1.5–)2–3(–3.5) mm, main vein subcentral or at a distance of 1/3 of the width of the leaflet from the front margin. Pod 16–22 by (4.5–)5–7 cm, indehiscent. Seeds ellipsoid 17–26 by 6.5–9 mm.

Distribution — New Britain, southern New Ireland, Solomon Islands.

Habitat & Ecology — Primary and secondary rain forest, sometimes reported as emergent above the forest canopy; frequently a pioneer tree in areas disturbed by volcanic activity or landslides; altitude 15–800 m.

Uses — Used for the manufacture of canoes in the Talesea District, New Britain.

- c. subsp. ledermannii** (Harms) Kanis, *Brunonia* 2 (1980) 300. — *Serianthes ledermannii* Harms, *Bot. Jahrb.* 55 (1917) 43. — *Albizia minahassae* Koord. var. *ledermannii* (Harms) Fosb., *Reinwardtia* 7 (1965) 85 (also incl. var. *proliferata* Fosb., l.c. 83 and var. *umbellata* Fosb., l.c. 84).

Petiolar gland 1.5–2.5(–3.5) mm long, elliptic, raised, concave in the central part, rimmed. Leaflets 4–7 by 1.5–2(–2.5) mm, the main vein at a distance of 1/3 or less of the width of the leaflet from the front margin. Pod 9–18.5 by (2–)2.5–4 cm, indehiscent. Seeds not seen.

Distribution — *Malesia*: New Guinea, Aru Islands.

Habitat & Ecology — Primary rain forest, level or steeply sloping; soil clayey, sandy or rocky, sometimes only in a thin layer over limestone; altitude 0–200(–750) m.

Subgenus *Serianthes*

Inflorescences composed of racemosely arranged pedunculate racemes, umbels or glomerules. Pods indehiscent, with thin and flaking epicarp and a woody endocarp.

Distribution — About 20 species including 4 imperfectly known ones, distributed within the total range of the genus.

Section *Serianthes*

*Serianthes* subg. *Serianthes* sect. *Serianthes* Nielsen in Nielsen, Guinet & Baretta-Kuipers, *Bull. Mus. Natn. Hist. Nat. Paris, sér. 4, 6, sect. B, Adansonia* no 1 (1984) 93.



Inflorescence a compound raceme. Stamens white or cream. Pod with a thin and flaking epicarp and a thick, woody endocarp. Seeds solitary in separate compartments.

Distribution — About 4 (5?) species, in *Malesia* (3), Micronesia (Carolines, 1), and perhaps W Polynesia (Fiji: *S. vitiensis* A. Gray).

**2. *Serianthes grandiflora*** Benth., Lond. J. Bot. 3 (1844) 225; Nielsen, Bull. Mus. Natn. Hist. Nat. Paris, sér. 4, 6, sect. B, *Adansonia* no 1 (1984) 93. — *Albizia grandiflora* (Benth.) F. Muell., Fragm. 8 (1874) 165, p.p. — *Serianthes dilmyi* Fosb., Taxon 8 (1959) 65; Reinwardtia 5 (1960) 300; Taxon 12 (1963) 34; Backer & Bakh. f., Fl. Java 1 (1963) 550; Fosb., Taxon 18 (1969) 351; Whitm., Tree Fl. Malaya 1 (1972) 289; Verdc., Manual New Guin. Legum. (1979) 197; Kanis, Brunonia 2 (1980) 312; nom. inval.

Tree up to 35 m high, free bole up to 10 m, 66 cm in diameter. *Leaves*: rachis 16–34(–45) cm, subglabrous or ± tomentellous; petiole 4.5–10 cm, with a gland 0.5–2.5 cm above the base, 1–4 mm long, circular to elliptic, flat or slightly sunken into the rachis; pinnae 7–10 pairs, 4–16 cm long; leaflets 6–18 pairs per pinna, alternate, trapezoid-oblong, (8–)12–29 by 6–13 mm, base strongly asymmetrically truncate, apex broadly rounded, asymmetrical, often emarginate, both surfaces glabrous; main vein starting near the basiscopic margin and running diagonally over more than the middle third of the leaflet towards the acroscopic side of the apex, lateral veins prominent, reticulate. *Inflorescences* tomentellous, up to c. 16 cm long. *Flowers*: pedicel 2–10 mm. Calyx yellow to yellow-brown, (cylindrical to) obconical, often nearly bilabiate, 11–15 mm long, tomentose; teeth, when regular, triangular, acute, 2–5 mm long. Corolla yellow to yellow-brown, funnel-shaped, 23–32 mm long, woolly, lobes (elliptic-) oblong, 10–20 mm long; tube shorter than or ± as long as the calyx. *Stamens* white, up to 50 mm long, tube only slightly exceeding the corollatube. Ovary sessile, glabrous. *Pod* black, woody, oblong, sometimes slightly twisted, sometimes wider in the distal part, 5.5–18 by 3.8–5.8 cm, margins slightly raised, valves with numerous hardly visible transverse anastomosing veins and often with 3–5, slightly branched, raised, accessory veins; epicarp peeling off at maturity, endocarp woody. *Seeds* ellipsoid, 12.5–14.5 by 6–7.5 mm, areole oblong, pleurogram parallel to the margin, open towards the hilum. — **Fig. 25.**

Distribution — S Thailand (Koh Tarotao); in *Malesia*: Malay Peninsula, Sumatra, Java, Philip-

pinas, Borneo (Sabah), Celebes, Moluccas, W Irian, and Manus Is.

Habitat & Ecology — Scattered, though sometimes locally rather common, mostly along seashores and in the sandy area behind the mangrove, sometimes near river mouths; on clayey, sandy or rocky soils, sometimes on limestone.

Note — Quite variable in flower size, sometimes even in one specimen, corolla length ranging from 23 to 32 mm.

**3. *Serianthes hooglandii*** (Fosb.) Kanis, Brunonia 2 (1980) 307, f. 2–4; Verdc., Manual New Guin. Legum. (1979) 198, f. 52; Nielsen, Bull. Mus. Natn. Hist. Nat. Paris, sér. 4, 6, sect. B, *Adansonia* no 1 (1984) 94. — *Serianthes kanehirae* Fosb. var. *hooglandii* Fosb., Reinwardtia 5 (1960) 303.

*Serianthes grandiflora* auct. non Benth.: K. Schum. & Hollr., Fl. Kaiser Wilhelm Land (1889) 102; K. Schum. & Lauterb., Fl. Deut. Schutzgeb. Südsee (1901) 345; Harms, Bot. Jahrb. 55 (1917) 40.

#### subsp. *hooglandii*

Tree up to 35 m high; bole up to 20 m, d.b.h. c. 100 cm, ± spurred or slightly buttressed at base. *Leaves*: rachis (9–)12–31 cm, tomentellous or glabrous, petiole 2.3–8 cm, with a gland 0.6–1.7 cm above the base in the lower half of the petiole, 2–4 mm long, (circular or) elliptic, often raised in the distal portion only; pinnae 6–10(–11) pairs, opposite or subopposite, 5–17 cm long, tomentellous or glabrous; leaflets 8–20 alternate pairs per pinna, oblong, (7–)9–17(–23) by 3–9 mm, base asymmetrically truncate or half rounded/half truncate, apex asymmetrically rounded; upper surface glabrous, lower surface glabrous or puberulous especially in the acroscopic part, main vein starting from close to the basiscopic margin and diagonal across the central third of the lamina, lateral veins prominent beneath. *Inflorescences* 5–19 cm long, composed of racemously arranged, up to 8 cm long racemes, bearing the flowers in the distal part. *Flowers*: pedicels 4–7 mm long. Calyx ferruginously tomentellous, darker than the corolla, cup-shaped to obconical, (5–)7–10(–13) mm long, often indented halfway down; teeth 3–5 mm,

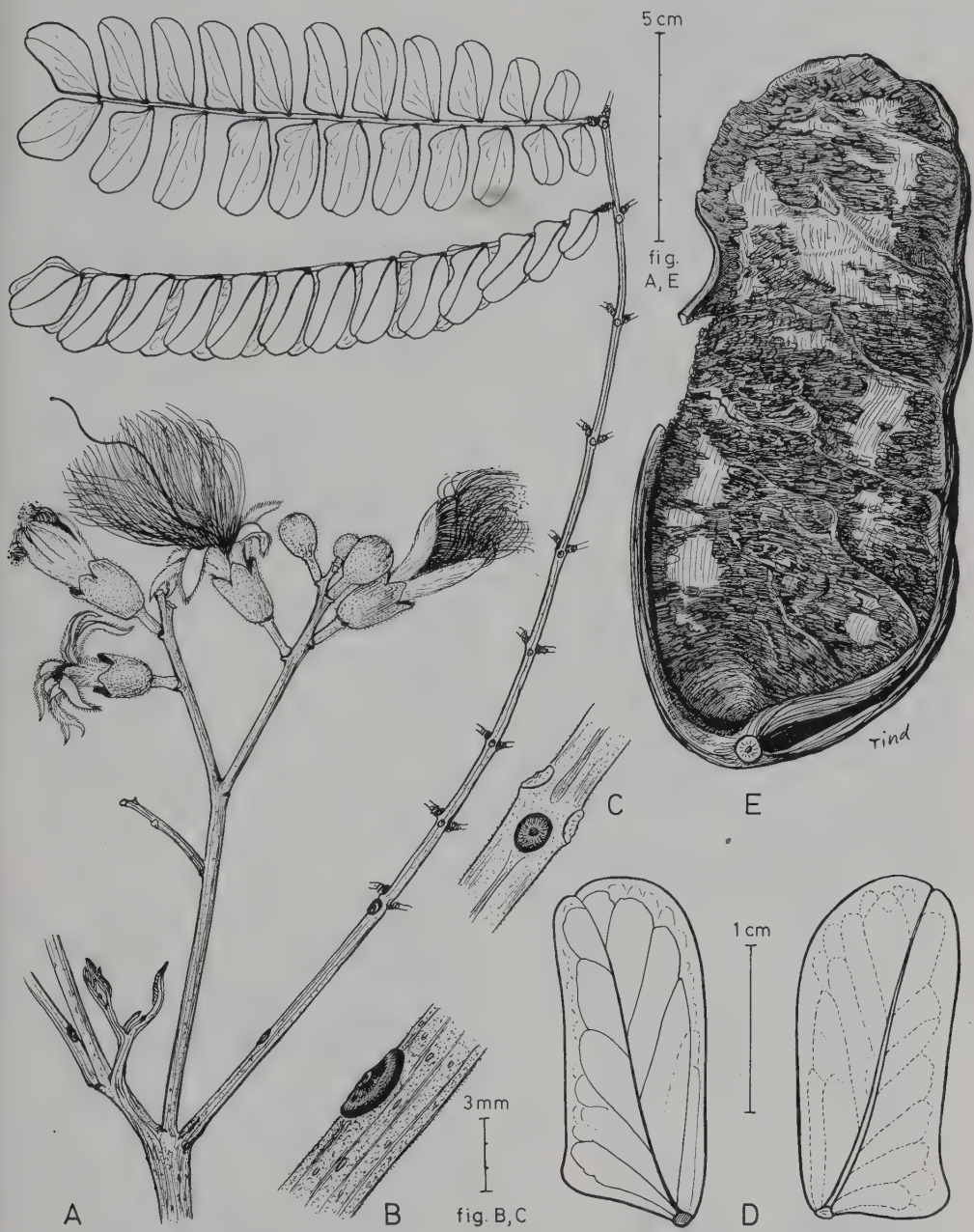


Fig. 25. *Serianthes grandiflora* Benth. A. Flowering branch; B. nectary on petiole; C. nectary on rachis; D. leaflet seen from below (left) and from above (right); E. pod (A–D: BW 3841; E: BW 5116).

triangular, acute. Corolla pinkish brown outside, densely sericeous, creamy white inside, 24–29 mm long, tube exserted, lobes ovate-elliptic to oblong, acute, 10–13 mm long. *Stamens* cream to grey, up to 60 mm long, staminal tube shorter than the corolla. *Pod* dull dark-brown, oblong, sometimes wider in the proximal part, 14.5–21.5 by 4.5–6 cm, sparsely puberulous or glabrous, margins strongly raised, valves with many hardly conspicuous transverse veins, and with c. 5 prominent longitudinal, raised veins which are sometimes forked near the middle. *Seeds* (obovoid-)ellipsoid, biconvex or flattened, 15–17 by 7.5–8 mm; areole oblong, c. 11.5–15 by 4 mm, pleurogram parallel to the margin and open towards the hilum.

**Distribution** – *Malesia*: Papua New Guinea and D'Entrecasteau Islands. Subsp. *floridensis* Kanis (l.c.: 312) occurs on Sandfly Is., Florida group, Solomon Islands.

**Habitat & Ecology** – Locally common in rain forest, but also occurring in savanna; level terrain to steep slopes, in ravines etc., soil sometimes reported as poorly drained, sometimes on limestone. In NE New Guinea: fl. Oct.–Mar., fr. July–Sep.; in SE New Guinea: fl. Jan.–July, fr. April–Sep.

**Note** – This species is very close to *S. robinsonii*, but has slightly smaller flowers, usually a deeper divided calyx, and the pods have stronger raised margins. The pollen of the two species is very similar too. *Serianthes hooglandii* has polyads 110–120 µm in diameter, *S. robinsonii* polyads 140 µm in diameter (Guinet in Nielsen, Guinet & Baretta-Kuipers, l.c.). *Serianthes robinsonii* and *S. hooglandii* with its two subspecies could also be considered as three replacing subspecies, in the Moluccas, New Guinea, and the Solomons.

4. *Serianthes robinsonii* Fosb., Reinwardtia 5 (1960) 301, p.p. (excl. New Guinea specimens); Kanis, Brunonia 2 (1980) 304, f. 2, Nielsen, Bull. Mus. Natn. Hist. Nat. Paris, sér. 4, 6, sect. B, Adansonia no 1 (1984) 94.

Tree up to 20 m or more, diameter 30 cm or more. *Leaves*: rachis (17–)20–30(–55) cm, shortly tomentose, petiole 4.5–7.5 cm, with 1 or 2 gland(s) in the lower half of the petiole, c. 1.5 mm in diameter, 1.5 mm high, raised; pinnae 9–12 pairs (up to 20 pairs in juvenile plants), alternate to opposite, up to 13 cm long; leaflets (15–)18–23(–30) pairs per pinna, alternate, oblong, only slightly curved, 10–15(–16) by 4–7(–7.5) mm, base asymmetrically truncate, apex asymmetrically rounded to broadly obtuse, sometimes slightly emarginate, upper surface glabrous or nearly so, lower glabrous or with a few scattered hairs, main vein starting from the basiscopic margin, diagonal across the central third of the lamina, lateral veins prominent beneath. *Inflorescence* composed of ± corymbiform arranged racemes, 4–5 cm long. *Flowers*: pedicel 4–10 mm long. Calyx broadly obconical, often slightly bilabiate, 10–13 mm long, yellowish to ferrugineously tomentose; teeth unequal, triangular, acute, 3–4 mm long. Corolla funnel-shaped, 27–36 mm long, yellowish or ferrugineously woolly, lobes oblong, acute, 15–20 mm long; tube slightly to strongly exserted beyond the calyx. *Stamens* to c. 50 mm long, tube shorter than the corolla. *Pod* oblong, woody, blackish brown, minutely puberulous, 20 by 6–6.5 cm, margins raised; valves with 4 or 5 rather straight and forked raised veins and with numerous small prominulous transverse not raised ones, not bullate over the seeds. *Seeds* narrowly ellipsoid, c. 17 by 6.5 mm, areole narrowly elliptic, c. 15 by 4 mm, pleurogram open towards the hilum.

**Distribution** – *Malesia*: Moluccas (Ambon, Ceram).

**Habitat & Ecology** – Once collected near the beach and once in a ravine; altitude c. 200 m. Fl. July, fr. Sep.

**Note** – Kanis (l.c.) clarified the taxonomy of this species, which is very close to *S. hooglandii* indeed.

## WALLACEODENDRON

*Wallaceodendron* Koord., Meded. Lands Pl. Tuin 19 (1898) 446, 630; Hutch., Gen. Fl. Pl. 1 (1964) 295; Nielsen in Nielsen, Guinet & Baretta-Kuipers, Bull. Mus. Natn. Hist. Nat. Paris, sér. 4, 5, sect. B, Adansonia no 4 (1983) 347.

Unarmed tree. Stipules not seen. *Leaves* bipinnate, rachis and pinnae with extrafloral nectaries; leaflets opposite. *Inflorescences* composed of pedunculate racemes axillary to the distal leaves. *Flowers* uniform, pentamerous, bisexual. Calyx connate, valvate.





Fig. 26. *Wallaceodendron celebicum* Koord. A. Leafy twig with inflorescences,  $\times 0.25$ ; B. leaf;  $\times 1$ ; C. fruit,  $\times 1$ ; D. opened fruit showing seeds,  $\times 0.3$  [after Koorders, Suppl. Fl. Celebes (1918) 3, t. 1].

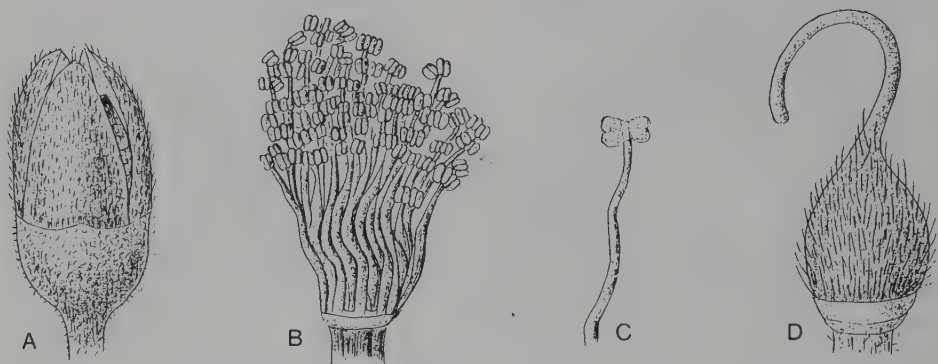


Fig. 27. *Wallaceodendron celebicum* Koord. A. Mature flower bud, just opened,  $\times 5$ ; B. stamens as seen after removal of the tepals,  $\times 8$ ; C. separate stamen,  $\times 13$ ; D. pistil,  $\times 20$  (after Koorders, Suppl. Fl. Celebes (1918) 3, t. 1).

Corolla connate, valvate. *Stamens* numerous, united into a tube at the base, staminal tube and corolla-tube shortly united at the base. Ovary solitary. *Pods* woody, flat, straight or slightly curved, tardily dehiscent, not segmented, not reddish inside; endocarp chartaceous, loosening, and at dehiscence forming small, closed envelopes around each seed. *Seeds* circular, flattened, unwinged, with pleurogram, without aril, testa thick, crustaceous; endosperm absent; cotyledons large. — **Figs. 26, 27.**

Distribution — Monotypic, endemic to *Malesia* (Philippines, N Celebes).

Note — The peculiar envelopes of the seed, formed by the endocarp, suggest that it possibly is dispersed locally by wind or water. The genus is unique by its pod characters. For further discussion of the characters see Nielsen et al. (l.c.: 348).

***Wallaceodendron celebicum*** Koord., Meded. Lands, Pl. Tuin 19 (1898) 446, 631; Gilg in E. & P., Nat. Pflanzenfam., Nachtr. 2 (1900) 30; Foxw., Philipp. J. Sc., Bot. 2 (1907) 376; Koord., Suppl. Fl. Celebes (1918) 3, t. 1a, b. *Pithecellobium williamsii* Elmer, Leaflet Philipp. Bot. 1 (1907) 223.

Tree to 45 m high, bole to 31 m high and to 160 cm in diameter, sometimes buttressed at the base. Branchlets terete, brownish, in the ultimate parts tomentose, glabrescent, dotted by numerous light brown lenticels. Stipules not seen. *Leaves*: rachis (1.5–)6–13 cm, sulcate in the distal part and there puberulous; petiole (0.7–)1.7–5.5 cm, with glands at the junctions of the pinnae, elliptic to circular, raised, convex, 1–1.5 mm in diameter;

pinnae 2–3 pairs, sulcate, faintly puberulous, glabrescent, (2–)3.5–10.5 cm, leaflets 3–6 pairs per pinna, rigidly chartaceous, petiolulate, ovate-elliptic, elliptic, obovate-elliptic or lanceolate-subtrapezoid, unequal-sided, 1.2–8 by (0.7–)1–4.2 cm, base symmetrically or asymmetrically cuneate, apex obtuse, shortly acuminate; main vein  $\pm$  central, lateral veins prominent above, prominent and reticulate beneath; both surfaces glabrous or main vein puberulous. *Inflorescence*: racemes solitary or paired, (7–)10–23 cm, including the 5–16 cm long peduncle, pedicels 0.6–1.2 cm, bracts triangular, c. 2 mm. *Flowers*: calyx rusty brown, cup-shaped, (2–)3–5 mm, shortly tomentellous, margin inconspicuously toothed. Corolla light brown outside, white inside, funnel-shaped, (7.5–)12–16.5(–19) mm, densely tomentose, lobes tri-

angular, ovate, or ovate-oblong, acute, reflexed (4–)5–9 mm. *Stamens* 30–45 mm, white with sulphurous anthers, tube 9–15 mm. Ovary solitary, densely tomentose or woolly, c. 3–5 mm; stipe 1–5 mm. *Pod* densely ferrugineously puberulous or tomentose (when young), glabrescent, oblong, flat, 9.5–20 by 2.5–4 cm, margins thickened, valves with prominulous transverse veins along both sutures, tardily dehiscent along both sutures. *Seeds* brown, suborbicular, flat, c. 13 mm in diameter, to 2 mm thick; areole c. 10 mm in diameter, pleurogram parallel to the margins, open towards the hilum, funicle thin, c. 15 mm. — **Figs. 26, 27.**

Distribution — *Malesia*: N Celebes, Philippines. — Fig. 28.

Habitat & Ecology — Primary rain forest, inland and near the sea-shore; altitude 0–850 m. Fl. Dec.–Sep.; fr. Jan.–Oct.

Uses. According to Foxworthy (l.c.), the wood is moderately hard and heavy, specific gravity 0.525, golden brown, with a fine grain similar to that of *Albizia acle*. Used for furniture, light construction, flooring, telegraph poles. Sometimes planted.

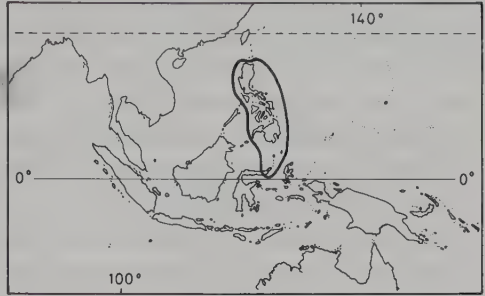


Fig. 28. Distribution of *Wallaceodendron celebicum* Koord.

## TRIBUS MIMOSEAE

*Mimosoideae* tribus *Mimoseae* Bronn, De Formis Plantarum Leguminosarum (1822) 130; Hutch., Gen. Fl. Pl. 1 (1964) 281; Lewis & Elias in Polhill & Raven (eds.), Adv. Leg. Syst. 1 (1981) 155.

*Mimosoideae* tribus *Eumimoseae* Benth., J. Bot. 4 (1842) 331; Benth. & Hook. f., Gen. Pl. 1, 2 (1865) 592; Taubert in E. & P., Nat. Pflanzenfam. 3, 3 (1891) 114.

*Eumimoseae* subtribus *Adenanthereae* Benth., J. Bot. 4 (1842) 331; Benth. & Hook. f., Gen. Pl. 1, 2 (1865) 589; Taubert in E. & P., Nat. Pflanzenfam. 3, 3 (1891) 117; Hutch., Gen. Fl. Pl. 1 (1964) 283.

*Piptadenia* Benth., Trans. Linn. Soc. 30 (1875) 352; Taubert in E. & P., Nat. Pflanzenfam. 3, 3 (1891) 121.

Calyx valvate in bud. Stamens as many or twice as many as the petals, free or ± connate at base; anthers gland-tipped or not.

Distribution — Pantropical to warm temperate.

## ADENANTHERA

*Adenanthera* L., Sp. Pl. (1753) 384; Benth., Trans. Linn. Soc. 30 (1875) 375; Hutch., Gen. Fl. Pl. 1 (1964) 287; Nielsen, Nordic J. Bot. 12 (1992) 85.

Unarmed trees or shrubs. Stipules not spinescent, inconspicuous and early caducous. *Leaves* bipinnate, not sensitive to the touch, rachis and pinnae without extrafloral nectaries; leaflets alternate. *Inflorescences* consisting of pendulous or erect, pedunculate, spiciform racemes; peduncles axillary, solitary or a few together in the axils of the terminal leaves or at the end of branches subtended by developing leaves; pedicels jointed. *Flowers*



pentamerous, uniform, bisexual. Calyx valvate, connate at base. Petals valvate, sometimes coherent at base and united for the lower 1/4 mm with the stamens, but soon splitting. *Stamens* 10, free; anthers with a stipitate, caducous gland at the top of the connective. *Pods* chartaceous-coriaceous, linear, straight, curved or spirally twisted, dehiscent along both sutures; the yellowish and glossy endocarp loosening from the dark epicarp, but not peeling off. *Seeds* red or partly red (in hilar end) and black, obliquely held in pod, ellipsoid, obovoid, orbicular or ovoid-ellipsoid, biconvex, compressed, with a hard testa with areole, wingless, aril absent, but funicle thick, endosperm present; cotyledons large and embryonic axis straight or acute angled to the hilum, radicle curved. — **Fig. 29.**

Distribution — Tropical Asia–Australia and Melanesia (Solomon Islands), 12 species in all, of which 9 in *Malesia*.

Habitat & Ecology — The species of *Adenanthera* are found in both primary and secondary rain forest and in open savanna-like vegetation at low altitudes up to 700 m. *Adenanthera forbesii*, *A. kostermansii*, *A. malayana*, and *A. novoguineensis* are tall rain forest trees up to 40 m high and 100 cm d.b.h., which sometimes develop buttresses up to 2.5 m high. *Adenanthera intermedia* is a smaller understorey tree of evergreen forests; *A. marina*, *A. microsperma* and *A. pavonina* are broad-crowned trees to c. 30 m tall in forests (Solomon Islands), in Malesia usually smaller and found in open habitats. The bright red or red and black seeds are held in the pod for a long period after the dehiscence, contrasting the yellowish glossy endocarp. The dispersal agents are probably birds. One species, *A. pavonina*, is widely cultivated.

Taxonomy — The genus belongs to the ‘*Adenanthera*-group’ [Lewis & Elias, *Mimosaeae*, in Polhill & Raven (eds.), *Adv. Leg. Syst.* 1 (1981) 155] of the *Mimosaeae*, characterized by the jointed pedicel with persistent basal part and the alternate leaflets. The African genera *Amblygonocarpus* and *Tetrapleura* are both vegetatively and florally indistinct from *Adenanthera*, the generic characters being derived from the morphology of the pod. *Pseudoprosopis* of tropical Africa seems to be more distantly related, having subopposite leaflets and pods with different dehiscence. None of these have red seeds. The present author (Nielsen, l.c.) recently dealt with the specific delimitation. The most important characters are those of the seeds, the indumentum of pedicel, calyx and ovary, and the form of the leaflets. Much work remains to be done in this genus regarding the development and architecture of the trees. From all over the range of the species systematic collection of flowering and fruiting material from the same specimen is needed in order to get a complete picture of the diversity.

#### KEY TO THE SPECIES

- |  |    |
|--|----|
| 1a. Fruiting specimens . . . . .   | 2  |
| b. Flowering specimens . . . . .   | 11 |
| 2a. Seeds bicoloured, glossy red with a black distal part . . . . .                      | 3  |
| b. Seeds uniformly glossy red . . . . .  | 9  |
| 3a. Apex of (at least young and developing) leaflets distinctly acute to acuminate . . . | 4  |
| b. Apex of leaflets rounded, truncate, often emarginate . . . . .                        | 5  |

- 4a. Base of leaflets cuneate; upper surface of leaflets without microscopic pellucid dots  
     **5a. *A. malayana* subsp. *malayana***
- b. Base of leaflets very broadly rounded to subcordate; upper surface of leaflets with microscopic pellucid dots . . . . . **1. *A. borneensis***
- 5a. Young branches glabrous or with a few scattered glandular hairs. Leaf rachis and pinnae glabrous . . . . . **3. *A. intermedia***
- b. Young branches puberulous. Leaf rachis and pinnae puberulous . . . . . 6
- 6a. Seeds asymmetrically oblong or rhomboid in outline; black spot only covering and parallel to the apical margin of the seed, c. 4–5 by 1 mm **8. *A. novoguineensis***
- b. Seeds obliquely or regularly obovoid, circular, or ellipsoid in outline, dark spot extending at least 1.5 mm on the face of the seed, not parallel to the apical margin . . . . . 7
- 7a. Leaflets rigidly chartaceous when dry, primary lateral veins parallel, straight and raised beneath . . . . . **5b. *A. malayana* subsp. *andersonii***
- b. Leaflets thinly chartaceous or membranous (often somewhat wrinkled when dry), primary lateral veins inconspicuous or hardly visible, arching, not parallel . . . . . 8
- 8a. Leaflets small, not exceeding 1.5 by 0.7 cm. Pod oblong, straight, valves recurving from the apex at dehiscence . . . . . **2. *A. forbesii***
- b. Leaflets larger, (0.8–)1.4–3.5 by (0.7–)0.9–2 cm. Pod contorted prior to and spirally twisted after dehiscence . . . . . **4. *A. kostermansii***
- 9a. Rachis of leaves (15–)20–55 cm. Pod linear falcate, not twisted prior to dehiscence, valves 1.3–1.8 cm broad. Seeds (7–)8–9 by 7–9.5 mm . . . . . **9. *A. pavonina***
- b. Rachis of leaves 2.5–21 cm. Pod linear, twisted prior to dehiscence, valves 0.8–1.2 cm broad. Seeds 4.7–7(–8) by 4.5–7 mm . . . . . 10
- 10a. Pinnae 3–5(–6) pairs, puberulous; leaflets (4–)5–9 on each side of the pinna. Tree to 30 m high . . . . . **7. *A. microsperma***
- b. Pinnae 1 or 2 pairs, glabrous; leaflets 2–4 on each side of the pinna. Shrub with slender branches, 1 cm in diameter . . . . . **6. *A. marina***
- 11a. Apex of (at least young and developing) leaflets distinctly acute to acuminate (leaflets with prominent, raised, straight, primary lateral veins beneath) . . . . . 12
- b. Base of leaflets very broadly rounded to subcordate; upper surface of leaflets with microscopic pellucid dots . . . . . **1. *A. borneensis***
- 12a. Base of leaflets cuneate; upper surface of leaflets without microscopic pellucid dots  
     **5a. *A. malayana* subsp. *malayana***
- b. Base of leaflets very broadly rounded to subcordate; upper surface of leaflets with microscopic pellucid dots . . . . . **1. *A. borneensis***
- 13a. Pinnae 1 or 2 pairs. Floral bracts persistent, cordate, cuspidate, 1–1.5 mm. Racemes short, c. 3.5 cm, glabrous . . . . . **6. *A. marina***
- b. Pinnae at least 3 or 4 pairs. Floral bracts early caducous, filiform, up to c. 1 mm. Racemes more than 6.5 cm long . . . . . 14
- 14a. Ovary ± densely appressed puberulous to sericeous or woolly . . . . . 15
- b. Ovary glabrous or with a few scattered hairs only . . . . . 17
- 15a. Basiscopic part of leaflet decurring into the petiolule; lower surface with inconspicuous lateral veins; leaflets up to 0.7 mm wide . . . . . **2. *A. forbesii***

- b. Basiscopic part of leaflet not decurring into the petiolule; lower surface with inconspicuous to prominulous lateral veins; leaflets (0.4–)0.7–2.2 cm wide . . . . . 16
- 16a. Racemes  $\pm$  densely patently pubescent. Calyx broadly cup-shaped, (0.5–)0.8–1.3 mm; teeth triangular, acute, (0.3–)0.5 mm . . . . . 8. **A. novoguineensis**
- b. Racemes puberulous. Calyx shallow, cup-shaped, 0.5–0.8 mm; teeth inconspicuous and rounded . . . . . 7. **A. microsperma**
- 17a. Leaflets rigidly chartaceous; primary lateral veins raised, straight and parallel beneath . . . . . 5b. **A. malayana** subsp. **andersonii**
- b. Leaflets thinly chartaceous or membranous; primary lateral veins not raised, sometimes inconspicuous . . . . . 18
- 18a. Pedicel and calyx glabrous or with a few scattered hairs only . . . . . 19
- b. Pedicel and calyx appressed or patently puberulous . . . . . 20
- 19a. Leaf rachis (15–)17–53 cm long. Raceme 12–50 cm. Calyx subrotate to broadly cup-shaped, 0.8–1 mm; teeth inconspicuous. Style  $\pm$  equalling the ovary, c. 2 mm long. . . . . 9. **A. pavonina**
- b. Leaf rachis shorter, usually 10–21 cm long. Raceme 10–15 cm. Calyx subrotate to broadly funnel-shaped, c. 0.5 mm; teeth deltoid, acute, c. 0.2 mm. Style 0.6–0.7 mm, much shorter than the 3 mm long ovary . . . . . 3. **A. intermedia**
- 20a. Leaflets small, not exceeding 1.5 by 0.7 cm . . . . . 2. **A. forbesii** p.p.
- b. Leaflets larger, (0.8–)1.4–3.5 by (0.7–)0.9–2 cm . . . . . 4. **A. kostermansii**

**1. Adenanthera borneensis** Brace ex Prain in King, J. As. Soc. Beng. 66, 2 (1897) 244; Cockburn, Trees Sabah 1 (1976) 185, p.p., quoad nomen; Nielsen, Nordic J. Bot. 12 (1992) 97, f. 8.

Tree to 21 m high, 100 cm girth. Branchlets glabrous. Stipules not seen. *Leaves*: rachis 4–9.5 cm, slightly laterally compressed, sulcate, glabrous; pinnae 1 or 2 pairs, 4–8 cm, angular, glabrous or with a few scattered hairs; petiolule 2 mm, glabrous; leaflets 2 or 3 on each side of the pinna, rigidly chartaceous, drying very glossy olive green above and chestnut brown beneath, ovate-elliptic to broadly elliptic, 3–6 by 2–3.2 cm, base symmetrical, broadly rounded to subcordate, apex strongly acuminate, acumen c. 0.6–0.7 cm long, both surfaces glabrous, upper with prominulous veins and microscopic, reddish brown (when dry) pellucid dots, lower surface with c. 9 prominent, oblique, parallel veins, connected with a lax reticulation of tertiary veins. *Racemes* not seen fully developed; pedicel 1.2 mm, glabrous. Calyx broadly cup-shaped, with inconspicuous teeth, minutely hairy at the mouth. Petals lanceolate, acute, 2.5 mm long, puberulous towards the apex. *Stamens* c. 4 mm; anthers 0.5 mm long. Ovary 1.5 mm, glabrous; style c. 1.5 mm, tubular. *Pod* dark brown-

ish, contorted into a short spiral at dehiscence, to c. 25 cm long and 2 cm wide, slightly sinuate between the seeds. *Seeds* up to 16, glossy red with a dark spot, suborbicular to broadly transversely elliptic, 7 by 8 by 5 mm, biconvex, dark spot c. 3 mm high; areole c. 6 by 7 mm, open towards the hilum.

Distribution – *Malesia*: Borneo (Sarawak, Kalimantan).

Habitat & Ecology – Primary and secondary rain forest; altitude up to 100 m.

Note – Known from three collections only.

**2. Adenanthera forbesii** Gagnep., Not. Syst. 2 (1911) 61; Nielsen, Nordic J. Bot. 12 (1992) 105.

*Adenanthera tamarindifolia* auct. non Pierre: Heyne, Nutt. Pl. Ned. Ind. 2 (1916) 225.

Tree to c. 30 m high; 169 cm d.b.h. Young branches densely puberulous to ferruginous tomentose with an indumentum of glandular and non-glandular hairs, glabrescent. Stipules not seen. *Leaves*: rachis 7–20 cm, densely puberulous, adaxially sulcate; pinnae (4–)6–9 pairs, 2.5–7.5 cm, densely puberulous, adaxially furrowed; petiolule c. 1 mm, puberulous; leaflets 5–13 on each side of the pinna, membranous, drying olive green



above and greyish green beneath, more or less obliquely (ovate to) broadly oblong, 0.7–1.5 by 0.4–0.7 cm, base asymmetric, basiscopic part decurring into the petiolule, cuneate, acroscopic part broadly cuneate-subtruncate; apex broadly rounded to truncate, upper surface glabrous or puberulous with inconspicuous lateral veins, lower surface densely appressed puberulous (to subglabrous), with hardly visible lateral veins, margin puberulous especially in the proximal part. *Racemes* (incl. peduncle) 9–15.5 cm long, densely puberulous; pedicel 1–2.8 mm, puberulous. *Flowers* light yellow. Calyx shallowly cup-shaped, 0.7 mm, appressed puberulous, teeth triangular, acute, 0.2 mm. Petals lanceolate-oblong, acute, 2.5–4 mm, glabrous-puberulous towards the apex. *Stamens* 3.5–4 mm, anthers 0.5 mm. Ovary densely hirsute to subglabrous, 2.3 mm, style c. 1.7 mm. *Pod* blackish, oblong, straight, c. 14–17 by 1.1–1.6 cm, valves recurving from the apex at dehiscence. *Seeds* c. 10, glossy red and black, obliquely obovoid to orbicular in outline, c. 7–8 by 6.5–7 by 4–4.5 mm, dark portion reaching to c. 3 mm down the seed surface; pleurogram obovate-circular, 5 by 4.6–5 mm, open towards the hilum, not parallel to the margin.

Distribution – *Malesia*: Sumatra (incl. Bangka), Borneo.

Habitat & Ecology – Rain forests at low altitudes, from sea-level up to 90 m; on yellow, sandy clay, and granitic sand. Fl. Oct.–Jan., fr. Dec., Feb.

Field notes – Crown with more or less horizontal branches. Buttresses sometimes present. Bark surface pink-brown, evenly uniformly grid cracked and shallowly crumbly flaked. Outer bark c. 0.25 mm in pink, yellow at cambium; sapwood rich yellow to orange, heartwood dark chocolate brown, fairly hard.

Note – The Sarawak specimen *S 26166* from Kuching has an ovary with a few scattered hairs only and the leaflets seem to be more glabrous than those of the Sumatran collections, which have  $\pm$  hirsute ovaries. Fruiting material from Sarawak unknown.

**3. *Adenanthera intermedia*** Merr., Philipp. J. Sc., Bot. 3 (1908) 228; *ibid.* 5 (1910) 32; Fl. Manila (1912) 229; Sp. Blanc. (1918) 168; Enum. Philipp. 2 (1923) 251; Nielsen, Nordic J. Bot. 12 (1992) 102, f. 10.

*Adenanthera pavonina* auct. non L.: Vidal, Sinopsis (1883) 24, t. 44, f. B; Phan. Cuming. (1885) 110, Rev. Pl. Vasc. Filip. (1886) 119.

Small or medium-sized tree to 19 m high; 30 cm d.b.h. Branches glabrous or with a few scattered glandular hairs. Stipules not seen. *Leaves*: rachis 10–21 cm, slightly laterally compressed, distinctly adaxially sulcate, glabrous; pinnae 2 or 3 (or 4) pairs, angular, glabrous, (3–)5–15 cm; petiole 1–2 mm, glabrous; leaflets (3–)4–6 on each side of the pinna, thinly chartaceous, drying dull lead-grey to green above and light green beneath, unequal-sided, elliptic to ovate-elliptic, 1.5–5 by 0.9–3 cm, base  $\pm$  symmetrical, (very) broadly cuneate to rounded, apex rounded-mucronulate to truncate-emarginate, both surfaces glabrous or upper surface glabrous-(puberulous) and lower appressed puberulous (a few specimens with pellucid dots), lateral veins prominulous, 5–9 at each side of the leaflet, slightly arching, not parallel, anastomosing near the margin. *Racemes* (incl. peduncle) 10–15 cm long, glabrous or with a few scattered hairs and glands only; bracts filiform, puberulous, (early) caducous, c. 0.5 mm; pedicel 1(–3) mm, glabrous or with a few scattered hairs only. Calyx broadly funnel-shaped to subrotate, c. 0.5 mm, glabrous; teeth deltoid, acute, about 0.2 mm long. Petals lanceolate, acute, 2.4–3.5 mm, glabrous. *Stamens* 4 mm; anthers c. 0.5 mm. Ovary sessile, c. 3 mm, glabrous; style 0.6–0.7 mm. *Pod* dark brown, strap-shaped, usually falcate prior to dehiscence, and spirally contorted after, often slightly constricted between the seeds, 10–18 by 0.9–2 cm. *Seeds* usually 10 or 11 per pod, glossy red with a black spot covering the distal 2–3 mm,  $\pm$  irregularly obovoid-ellipsoid, biconvex, 6–8 by 5–6 by 3–4 mm, areole c. 5 by 4 mm, open towards the hilum, not parallel to the margin.

Distribution – *Malesia*: Philippines (Luzon, Palawan, Mindanao).

Habitat & Ecology – Understorey of (rain) forest at low altitudes, up to 700 m. Fl., fr. probably all year round.

**4. *Adenanthera kostermansii*** Nielsen, Nordic J. Bot. 12 (1992) 100, f. 9.

Tree to 35 m high, d.b.h. 70 cm. Branchlets puberulous, with a mixture of glandular and non-glandular hairs. Stipules not seen. *Leaves*: rachis (8–)9–20(–24) cm, adaxially sulcate, puberulous by patent hairs; pinnae (2–)3–4(–5) pairs, puberulous by patent hairs, (1.5–)4.5–16 cm; petiolule 1–1.5 mm, patently puberulous; leaflets 4–8(–10) on each side of the pinna, thinly chartaceous, drying dull grey-green, sometimes glaucous beneath,  $\pm$  asymmetrically narrowly elliptic, ovate to obovate-elliptic or subtrapezoid (0.8–)1.4–3.5 by

(0.2–)0.9–2 cm; base  $\pm$  asymmetrically cuneate to truncate-rounded in the acroscopic portion and cuneate in the distal part; apex broadly acute to rounded or truncate(-emarginate), usually mucronulate; upper surface sparsely puberulous, lower surface puberulous, especially densely so on the main vein; lateral veins prominulous, c. 8–10 per leaflet-half, slightly arching, not parallel. *Racemes* (incl. peduncle) 6–10(–16) cm, densely puberulous by golden hairs (when dry) and scattered glandular hairs; pedicel 1–1.6 mm, appressed or patently puberulous, floral bracts filiform, 0.5 mm, puberulous, caducous. Calyx broadly cup-shaped to subrotate, 0.3–0.5 mm, appressed to patently puberulous; teeth triangular, acute, c. 0.1 mm. Petals yellow to yellowish white, elliptic-lanceolate, 2.5–4 mm, acute, glabrous. *Stamens* yellow to yellowish white, 3–4 mm; anthers greenish yellow, 0.5 mm. Ovary greenish yellow, glabrous, c. 1.5 mm, style 1.5 mm, stigma light green. *Pod* black, linear-oblong, contorted, after dehiscence spirally twisted, at least 11 by 1.4–1.6 cm. *Seeds* glossy red with black spot distally,  $\pm$  symmetrically suborbicular to obovoid in outline, c. 7 by 6.5–7 by 4 mm; black spot c. 4 mm wide by 1.5 mm high; pleurogram 6 by 5–6 mm, parallel to the margin, open towards the hilum.

*Distribution* – *Malesia*: Borneo, S Philippines (see note).

*Habitat & Ecology* – Primary rain forest, often on ridges, lowland Dipterocarp forest; soils various: sandy yellow clay, also in peat swamp and freshwater swamp forest; altitude sea-level up to 600 m. Fl. Mar.–Dec.; fr. possibly throughout the year.

*Field notes* – Buttresses sharp and narrow, to 2.5 m high and 20 cm wide, sometimes with a tendency to stiltroot habit. Bark pale brown to chocolate brown, smooth to finely cracked; sapwood white to dirty white; heartwood dark brown.

*Note* – Some specimens from the Philippines (Mindanao, Leyte, Surigao) are densely patently puberulous on leaf rachis and pinnae, and referred to the present species with doubt. Study of fruiting and flowering material is needed to decide if these specimens really belong here.

**5. *Adenanthera malayana*** Kosterm., Ceylon J. Sc. (Biol. Sc.) 12 (1977) 130; Nielsen, Nordic J. Bot. 12 (1992) 94, f. 6.

*Adenanthera bicolor* auct. non Moon: Baker, Fl. Br. India 2 (1878) 287, p.p., quoad Malaccan spec.; Prain in King, J. As. Soc. Beng. 66, 2 (1897) 243; Ridley, Fl. Mal. Pen. 1 (1922) 654; Burkill, Dict. Econ. Prod. Mal. Pen. 1

(1935) 45; Corner, Gard. Bull. Str. Settl. 10 (1939) 26; Wayside Trees 1 (1940) 408; Whitm., Tree Fl. Malaya 1 (1972) 276.

#### **a. subsp. *malayana***

Tree to 45 m high, 250 cm girth, sometimes with buttresses to 1.2 by 0.6 m. Young branches puberulous to densely puberulous, glandular hairs present. Stipules not seen. *Leaves*: rachis 5.5–12 cm, slightly laterally compressed, sulcate, puberulous to densely puberulous; pinnae 2 or 3 pairs, (3–)4.5–12 cm, angular, puberulous to densely puberulous; petiole 1–2 mm long, patently puberulous to setose; leaflets (2–)3–5 on each side of the pinna, rigidly chartaceous, drying dull lead-grey to brown above and darker brown beneath, very often slightly unequal-sided, (elliptic-)ovate to elliptic-suborbicular, 1.8–5(–8) by 1–4(–5) cm, base slightly asymmetrically cuneate, apex acute-rounded or very broadly rounded and emarginate, mucronulate, upper surface glabrous, lower appressed puberulous, indumentum patent along proximal part of main vein; principal lateral veins 8–10 per leaflet-half, oblique, straight, parallel, anastomosing at about 1/4 of the width of the leaflet. *Raceme* c. 8–15 cm long, rachis green, puberulous to densely puberulous, pedicel 1 mm long, puberulous. Calyx yellowish, broadly cup-shaped, 0.5–0.8 mm, puberulous; teeth triangular, acute 0.2–0.3 mm. Petals whitish, turning yellow, elliptic, acute, 2.5–3 mm, glabrous. *Stamens* whitish, turning yellow, 3.5–4.5 mm; anthers 0.5 mm. Ovary 1.5–2 mm, with scattered appressed hairs; style 1.5–2 mm. *Pod* purplish black outside, contorted into a spiral prior to dehiscence, c. 8–15 cm long; valves 1.5–1.7 cm wide, gradually narrowing into the inconspicuous stalk, c. 3 mm long. *Seeds* c. 10, glossy red and black, obovoid, ellipsoid, or orbicular, biconvex, 6.5–8 by 6.7–7 by 4–4.5 mm, distal black spot c. 5–6 mm wide and 2 mm high; pleurogram 5–5.5 by 5–6 mm, continuous between the two faces. – **Fig. 29.**

*Distribution* – *Malesia*: Malay Peninsula and Sumatra.

*Habitat & Ecology* – Primary and secondary rain forest. Can develop into a canopy tree; crown with bright pale green foliage, spreading, flat and diffuse. Recorded from rocky and from sandy soil; altitude sea-level up to 900 m. Fl. Feb.–Oct. fr. Feb.–Dec.

*Field notes* – Bark smooth or smooth-rugose with adherent thin strips; brown to grey-brown; slashwood cream, pale-yellow, or yellowish brown.



Fig. 29. *Adenanthera malayana* Kosterm. subsp. *malayana*. A. Habit; B. inflorescence; C. detail of inflorescence showing buds and open flower; D. mature pod; E. seed (A: KEP/FRI 11085; B, C: Maxwell 77-192; D, E: Maingay 591).



Uses – Frequently planted in villages and at roadsides. See also Burkill (l.c.).

Note – Variable regarding size and form of leaflets. Leaflets in flowering specimens usually small and acute, and thin just below the inflorescence.

**b. subsp. *andersonii*** Nielsen, *Nordic J. Bot.* 12 (1992) 97, f. 7.

Differs from subsp. *malayana* in the following aspects: Leaves: rachis 8.5–19 cm long; apex of leaflets truncate and often slightly emarginate, mucronulate. Ovary (very young flower) 2 mm; style c. 0.75 mm. Pod with valves up to 1.4 cm wide, slightly sinuate between the seeds. Seeds c. 12, glossy red with a dark spot, suborbicular, 6–6.5 by c. 4 mm, biconvex, dark spot c. 2 mm high; pleurogram 5 by 5 mm.

Distribution – *Malesia*: Borneo (Sarawak, Kalimantan).

Habitat & Ecology – Recorded from peat swamp forest and forest on sandy soil; altitude at sea-level. Fl. Jan.; fr. Jan., Apr.

Field notes – Short buttresses to 0.9 m; bark smooth and pale brown; leaflets glaucous beneath.

**6. *Adenanthera marina*** Nielsen, *Nordic J. Bot.* 12 (1992) 113, f. 17.

Shrub c. 3 m high, branches c. 1 cm in diameter. Branchlets glabrous. Stipules broadly oblong, c. 1.5 mm, inconspicuous, fused with the branchlets. *Leaves*: rachis 2.5–7 cm, mucronate, adaxially sulcate, glabrous; pinnae 1 or 2 pairs, angular-sulcate, glabrous, 4.5–6.2 cm; petiolule 0.5 mm, glabrous; leaflets 2–4 on each side of the pinna; thickly chartaceous-fleshy, drying bright deep green above and light green beneath, slightly asymmetrically ovate, 2.3–4.1 by 1.5–2.8 cm, base asymmetrically rounded, apex truncate (to rounded), mucronulate, both surfaces glabrous, lateral veins about 7 per leaflet-half, hardly visible, oblique, straight, non-parallel. *Racemes* 3.5 cm, glabrous; bracts scarious, cordate and cuspidate 1–1.5 by 0.8 mm, glabrous, persisting for some time; pedicels 2.5 mm, glabrous. *Flowers* cream to yellow. Calyx cup-shaped, 0.75 mm, glabrous; teeth triangular, acute, 0.3 mm. Petals broadly oblong, acute, 3 mm, glabrous. *Stamens* c. 3 mm; anthers 0.5 mm. Ovary c. 1.5 mm, glabrous; style c. 0.7 mm. *Pod* black when ripe, linear, curved, c. 7 by 0.9 cm, valves  $\pm$  sinuate between the seeds, spirally twisted after dehiscence, 6–8(–11) seeded. *Seeds* uniformly red, suborbicular to obliquely obovoid, 4.5–6 by 4.5–6 by 3.5–4 mm, strongly convex,

pleurogram c. 4 by 4.5 mm, linea fissura  $\pm$  parallel to the margin, open towards the hilum.

Distribution – *Malesia*: Malay Peninsula (Trengganu, Pahang).

Habitat & Ecology – Beach thickets, on sandy beaches. Fl. July; fr. Jan., June, July.

Field notes – Bark pinkish red, fissured; leaflets fleshy, bright deep green above, light green beneath.

Note – Known from four collections only. Grows in Malaya in a similar habitat as *A. pavonina*.

**7. *Adenanthera microsperma*** Teijsm. & Binnend., *Nat. Tijds. Ned. Ind.* 27 (1864) 58; Backer & Bakh. f., *Fl. Java* 1 (1963) 563; Verdc., *Manual New Guin. Legum.* (1979) 137; Nielsen, *Nordic J. Bot.* 12 (1992) 112, f. 16. — *Adenanthera pavonina* L. var. *microsperma* (Teijsm. & Binnend.) Nielsen, *Adansonia sér.* 2, 19 (3) (1980) 341; *Fl. Camb. Laos Vietnam* 19 (1981) 15, pl. 1: 13–18; *Fl. Thailand* 4, 2 (1985) 140, p.p., excl. syn. *A. tamarindifolia* Pierre.

Tree to 30 m high, to 90 cm girth. Branchlets glabrous or puberulous, glabrescent. Stipules not seen. *Leaves*: rachis 12–21 cm, adaxially sulcate, puberulous; pinnae 3–5(–6) pairs, puberulous, 5.7–11 cm; petiolules 1–2 mm, puberulous (or glabrous); leaflets (4–)5–9 on each side of the pinna, thinly chartaceous, drying light brown to dull grey-green above and light grey-green beneath, asymmetrically ovate-oblong, oblong-obovate, or sub-trapezoid, 1–2.7 by 0.6–1.8 cm; base partly cuneate/partly rounded, apex rounded to truncate, often emarginate or mucronulate, both surfaces puberulous to glabrous, lateral veins prominulous, 8–10 per leaflet-half, oblique, non-parallel, anastomosing near the margin. *Raceme* (incl. peduncle) 6.5–11.5(–25) cm, puberulous; floral bracts filiform, 0.75 mm, caducous; pedicel 1.5–3 mm, usually puberulous to sericeous (rarely glabrous). *Flowers* yellowish white, turning dark yellow at anthesis. Calyx shallow, cup-shaped, 0.5–0.75 mm, faintly appressed puberulous to sericeous (rarely glabrous); teeth inconspicuous, rounded. Petals 2.5–3.5 mm, oblong, acute, usually glabrous but occasionally puberulous towards the apex. *Stamens* 3–4.5 mm; anthers 0.5 mm. Ovary 1.6–2.2 mm, densely sericeous (with a few appressed hairs); style 1–1.5 mm, shorter than the ovary. *Pod* brown to dark brown, densely spirally contorted before dehiscence, up to 15 by 0.8–1.2 cm, 6–10 seeded. *Seeds* bright scarlet red, suborbicular to ellipsoid or broadly obovoid, 5.5–7(–8) by 4.5–7 by 4 mm, areole running c. 1 mm from the margin of the seed, open towards the hilum.

Distribution – Burma, S China, Indo-China, Thailand, Andaman Islands; in *Malesia*: Malay Peninsula, Java, Lesser Sunda Islands (Timor), also cultivated.

Habitat & Ecology – Dry evergreen and deciduous forests, forest margins, altitude sea-level up to 600 m. Flowering and fruiting throughout the year.

Uses – Shade tree for coffee (Java); also as an ornamental.

Note – Formerly included as a variety in *A. pavonina* (Nielsen 1980, 1981, 1985), but indumentum, leaf, flower and seed characters appear to be sufficiently different in *A. microsperma* for specific distinction (see the Key to the species (p. 166), and Nielsen 1992).

**8. *Adenanthera novoguineensis*** Baker f. in Merr. & Perry, J. Arnold Arbor. 20 (1939) 329; Verdc., Manual New Guin. Legum. (1979) 137; Nordic J. Bot. 12 (1992) 107, f. 13.

*Adenanthera microsperma* auct. non. Teijsm. & Binnend.: Merr. & Perry, J. Arnold Arbor. 23 (1942) 396, quoad *bb* 25744 and *Brass & Versteegh* 13567.

Tree to 40 m high, d.b.h. to 100 cm. Branchlets ± puberulous to glabrous, with glandular and non-glandular hairs. Stipules not seen. *Leaves*: rachis (9.5–)10–20(–35) cm, adaxially distinctly sulcate, puberulous; pinnae (3–)4–8 pairs, angular, densely puberulous; petiolule 0.5–1.5 mm, puberulous; leaflets (2–)3–9 on each side of the pinna, thinly chartaceous to membranous, drying lead-grey or dull dark green above and light grey to dull light green beneath, asymmetrically (obovate-) oblong, elliptic or sub-trapezoid, (0.5–)0.7–3.3 by (0.4–)0.7–2.2 cm; base asymmetrically cuculate/rounded; apex truncate, retuse or emarginate (to broadly rounded), upper surface glabrous to densely puberulous, lower surface sparsely puberulous to velutinous, pellucid dots not seen; lateral veins invisible to prominent, c. 6–8 per leaflet-half, ± parallel, arching and anastomosing near the margin. *Racemes* (incl. peduncle) to 30 cm long and 1.5–2 cm wide, ± densely patently puberulous; bracts filiform, 0.75–1 mm, sericeous, very early caducous; pedicel 1.8–3(–5) mm, ± densely puberulous; calyx broadly cup-shaped, (0.5–)0.8–1.3 mm, ± densely puberulous; teeth triangular, acute, (0.3–)0.5 mm. Petals white, cream or pale yellow, oblong, acute, 3–3.5 mm, glabrous or puberulous in the distal portion. *Stamens* 4 mm, filaments pink to dull pink, anthers orange yellow to dark brown (after dehiscence), 0.6 mm. Ovary ± densely

puberulous to woolly, 2 mm, style 1.5 mm, stigma tubular, creamy green. *Pod* dark brown, strap-shaped to subfalcate, (7–)11–19 by 1.3–2 cm, twisting after dehiscence, with 10–14 seeds. *Seeds* glossy dark red with apical black margin, asymmetrically oblong or rhomboid in outline, compressed, (5–)6–8(–9.5) by 5.5–8 by 3–4 mm; pleurogram c. 0.75–1 mm from the margin, open towards the hilum, parallel to the margin in the distal part of the seed; dark spot 4–5 mm broad and 1 mm high.

Distribution – *Malesia*: New Guinea, including New Ireland and New Britain.

Habitat & Ecology – Lowland and foothill rain forest, open woodland; a canopy or subcanopy tree, recorded from sand, clay, limestone and rocky soil; altitude sea-level up to 600 m; probably flowering and fruiting all year round.

Field notes – Bole to 16 m, buttresses up to 1 m high, 1 m wide and 4 cm thick. Bark reddish grey-brown or light brown, peeling in large irregular flakes, corky and sometimes with small rectangular fissures with distinct horizontally raised, corky lines; middle and inner bark creamy to light red; wood moderately hard and heavy; sapwood white-straw; heartwood yellow turning brown towards the centre.

Note – Verdcourt (l.c.) commented on the variation in this species. Aberrant specimens with up to 9 small leaflets on each side of the up to 9 pairs of pinnae, with dense indumentum, have been collected in the N part of New Guinea, but fruiting material is lacking. Two specimens with broad pods, 1.8–2 cm wide, have been collected in New Britain (NGF 17046, 32643). Pullen 7276 from Western Province, Upper Fly River, with nearly obovoid seeds, glabrous pedicel and calyx, and subglabrous ovary, is very close to *Adenanthera intermedia* indeed. Form and colour pattern of the seeds seem to be constant, but pods and ripe seeds are needed from all over the range of this species to prove whether three taxonomic units (subspecies?), as indicated by the differences in size of leaflets and pods, are concerned.

**9. *Adenanthera pavonina*** L., Sp. Pl. (1753) 384; Corner, Wayside Tr. 1 (1940) 407; Backer & Bakh. f., Fl. Java 1 (1963) 563; Whitm., Tree Fl. Mal. 1 (1972) 276; Meijer, Field Guide Tr. W. Mal. (1974) 177; Cockburn, Trees Sabah 1 (1976) 184; Verdc., Manual New Guin. Legum. (1979) 138; Nielsen, Fl. Camb. Laos Vietnam 19 (1981) 14, pl. 1: 7–12; Fl. Thailand 4, 2 (1985) 139, f. 32: 10–14; Nordic J. Bot. 12 (1992) 110, f. 15.

*Corallaria parvifolia* Rumph., Herb. Amb. 3 (1743) 143, t. 109.

*Adenanthera ? polita* Miq., Fl. Ind. Bat. 1 (1855) 47.

*Adenanthera gersenii* Scheffer, Flora 52 (1869) 307; Nat. Tijds. Ned. Ind. 31 (1870) 18, 357.

Small to medium-sized tree, c. 25–40 m high and 45 cm in diameter; branchlets glabrous (rarely puberulous); stipules filiform, 0.5 mm, puberulous, caducous. *Leaves*: rachis (15–)20–55 cm, adaxially sulcate, glabrous, pinnae (2–)3–6 pairs, (6.5–)8–20 cm, glabrous or puberulous adaxially; petiolules 1.5–2 mm, glabrous; leaflets 4–9(–11) on each side of the pinnae, thinly chartaceous, drying light brown to dull grey-green above and light grey-green beneath, elliptic to ovate or obovate-elliptic, 1.5–4.5 by 1–2.2 cm; basiscopic part of base broadly cuneate, acroscopic part truncate to rounded, apex rounded to truncate, often mucronulate; upper surface glabrous with indistinct veins, lower surface appressed puberulous, with 8–10 veins per leaflet-half, straight, parallel, anastomosing, prominulous. *Racemes* (incl. peduncle) 12–30 cm, glabrous or slightly puberulous, often with a few scattered glandular hairs; bracts lanceolate, 0.5 mm, puberulous; pedicels 2.5–6 mm, glabrous or sparsely appressed puberulous. *Flowers* white to yellowish, turning dark yellow after anthesis. Calyx 0.8–1 mm, subrotate to broadly cup-shaped, glabrous or sparsely appressed puberulous; teeth inconspicuous or rounded, c. 0.2 mm. Petals 3–5 mm, oblong, acute, glabrous or sparsely appressed puberulous. *Stamens* 3.8–5.5 mm. Ovary 2.5–3 mm, glabrous or with a few scattered hairs only, style 2–2.5 mm, about as long as the ovary. *Pod* brown, linear-falcate, 25 by 1.3–1.8 cm, usually  $\pm$  straight prior to dehiscence, contorted to spirally twisted after dehiscence, with up to 25 seeds. *Seeds* uniformly bright scarlet-red, ellipsoid, suborbicular or obovoid, (7–)8–9 by 7–9.5 mm,

up to 6.5 mm thick, convex; pleurogram c. 1–1.5 mm from and parallel to the margin, open towards the hilum.

**Distribution** – Throughout tropical Asia from Sri Lanka (type) to Melanesia. In *Malesia* widely cultivated, but seems to be spontaneous in coastal non-mangrove communities from the Malay Peninsula (Corner 1940), Greater Sunda Islands, Celebes, Lesser Sunda Islands through the Moluccas (Morotai, Ambon) to New Guinea; in the Philippines only known from cultivation.

**Habitat & Ecology** – Forest margins, alluvial forest, strand forest, primary and secondary lowland rain forest; many records from habitats near the sea; altitude sea-level up to 600 m; probably flowering and fruiting all year round.

**Field notes** – Crown rather uneven, rounded with dark green foliage; in open associations often a shrub or tree with spreading branches; in inland rain forest it may grow into a large, single-boled tree, rarely with buttresses. Bark brown or brownish grey, slightly peeling to flaking. Wood moderately hard and heavy, white or straw-coloured. Flowers strongly fragrant. Anther gland globular, pink, 0.25 mm in diameter.

**Uses** – Widely cultivated as ornamental because of the glossy red seeds that are used for necklaces. Young leaves used as a vegetable. Shade tree. The wood is sometimes used for indoor constructions.

**Notes** – The original distribution of this species in Asia is unknown. It is probably indigenous in E Malesia to Melanesia, where it is found as an integrated part of the primary forest. Probably because of the red seeds it has been introduced to India in prehistoric times and there a red dye is prepared from the heartwood, used for the forehead spot of the Brahmins. Introduced in all tropical areas, the seeds being used in rosaries and necklaces.

Specimens from Celebes tend to have narrowly elliptic, obtuse leaflets.

## DICHROSTACHYS

*Dichrostachys* W. & A., Prod. (1834) 271; Benth., J. Bot. 4 (1842) 353; Trans. Linn. Soc. 30 (1875) 382; Brenan, Fl. Trop. E. Afr., Leg.-Mim. (1959) 36; Hutch., Gen. Fl. Pl. 1 (1964) 291, nom. cons. [against *Cailliea* Guillem. & Perr. (1832)]; Brenan & Brummitt, Bol. Soc. Brot., sér. 2A, 39 (1965) 61; Fl. Zamb. 3 (1970) 37. — *Desmanthus* Willd. sect. *Dichrostachys* DC., Mém. Legum. 12 (1825) 428.

Shrubs or small trees with short-shoots terminated by spines or composed of many persistent fused stipules and (sometimes) bracts. *Leaves* bipinnate, rachis and pinnae with extrafloral nectaries; leaflets opposite, sessile. *Inflorescences* of axillary spikes solitary or



clustered. *Flowers* pentamerous; lower ones sterile with 10 filiform staminodes; central ones male, with 10 stamens, uppermost ones with 10 stamens and an ovary. Calyx connate, valvate, shortly toothed. Petals  $\pm$  united below. *Stamens* 10, free, all fertile in bisexual flowers; anthers (in Malesian species) with a stalked caducous apical gland; staminodes of sterile flowers elongate, without anthers. Ovary solitary. *Pods* clustered, coriaceous, narrowly oblong or linear, compressed, usually irregularly contorted or spiral, indehiscent or opening irregularly, endocarp not forming envelopes around each seed. *Seeds* ovoid to ellipsoid,  $\pm$  compressed, deep-brown, glossy, with pleurogram, wingless, aril and endosperm absent; cotyledons large, radicle curved. — **Fig. 30.**

**Distribution** — About 12 species, in Africa and Madagascar (numerous), one species with three subspecies extending its range to Asia: India, Burma, *Malesia* (Java, Lesser Sunda Islands), to N Australia.

**Habitat & Ecology** — Generally species of poor (sometimes clayey) soils requiring a dry season.

**Taxonomy** — Lewis & Elias [in Raven & Polhill, *Adv. Leg. Syst.* 1 (1981) 167] reassessed the limits of this genus towards the closely related genera *Gagnebina*, *Desmanthus*, and *Neptunia*.

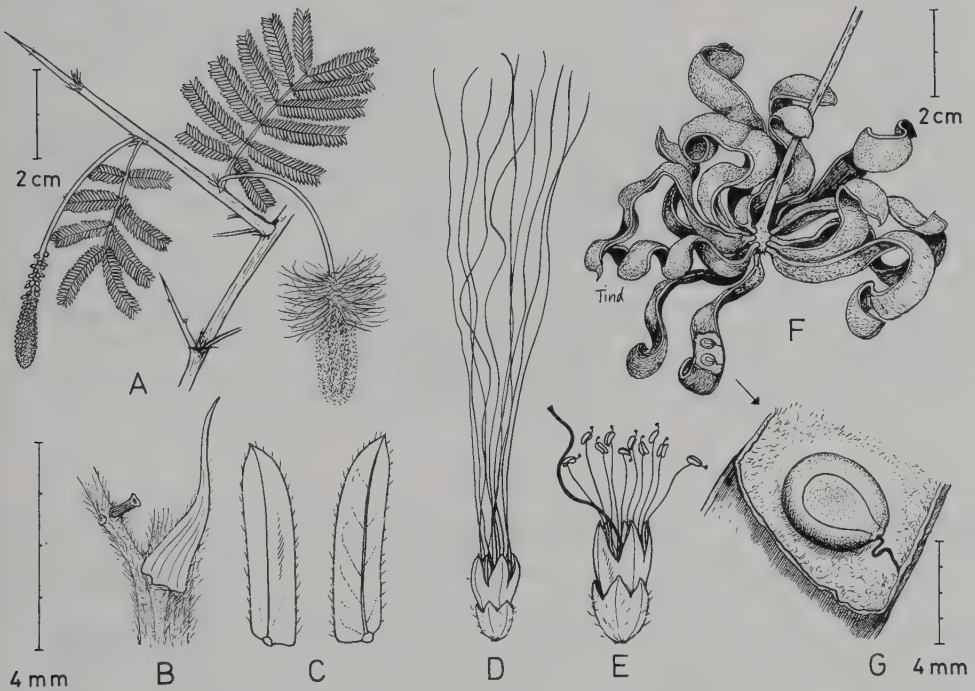


Fig. 30. *Dichrostachys cinerea* (L.) W. & A. subsp. *malesiana* Brenan & Brummitt. A. Habit; B. stipule and leaf base; C. leaflets seen from above (left) and below (right); D. neuter flower; E. bisexual flower; F. cluster of pods; G. seed (A–C: *Kostermans 18023*; D, E: *Backer 20399*; F, G: *Hissink 6344*).

**Dichrostachys cinerea** (L.) W. & A., Prod. 1 (1834) 271; Backer & Bakh. f., Fl. Java 1 (1963) 562; Brenan & Brummitt, Bol. Soc. Brot. sér. 2A, 39 (1965) 61. — *Mimosa cinerea* L., Sp. Pl. (1753) 520.

*Mimosa nutans* Pers., Syn. 2 (1807) 266. — *Dichrostachys nutans* (Pers.) Benth., J. Bot. 4 (1842) 353; Trans. Linn. Soc. 30 (1875) 382.

*Dichrostachys cinerea* var. *paucijuga* Miq., Fl. Ind. Bat. 1 (1855) 48.

*Dichrostachys callistachys* auct. non DC. ('*calistachys*'): W. & A. ex Hassk., Pl. Jav. Rar. (1848) 415.

Distribution – Widespread in Africa and Asia, through *Malesia* to Australia.

Note – Brenan & Brummitt (l.c.) recognize 10 subspecies, one of which, subsp. *malesiana*, occurs in S Thailand, *Malesia*, and Australia.

subsp. ***malesiana*** Brenan & Brummitt, Bot. Soc. Brot. sér. 2A, 39 (1965) 113.

*Dichrostachys cinerea* var. *paucijuga* Miq., Fl. Ind. Bat. 1 (1855) 48; Sumatra (1860) 105.

*Dichrostachys callistachys* auct. non DC. ('*calistachys*'): W. & A. ex Hassk., Pl. Jav. Rar. (1848) 415.

Shrub or small tree, 2–8 m high, diameter of stem 5 cm or less. Young branchlets densely to sparsely spreading, pubescent to puberulous; spines to 8 cm long. Stipules filiform, c. 3 mm. *Leaves* distichous or fasciculate with small stipules on short-shoots; rachis (1–)3–6 cm, rachis-glands columnar or stipitate, 0.5–1 mm, 0.1–0.2 mm in diameter, situated at the junctions of all the pairs of pinnae, or spaced above the base, pubescent with minute reddish glandular hairs, usually conspicuously so especially near insertions of pinnae and leaflets and on young stems; pinnae 2–11 pairs, 1.5–3 cm, with inconspicuous glands; leaflets

opposite, sessile, 12–24 pairs per pinna, linear, (2.5–)3–6 by (0.8–)1–1.5 mm, base oblique, apex sharply acute, both surfaces glabrous, margins rather sparsely and shortly ascending or appressedly ciliate; venation invisible to rather obscure beneath. *Inflorescence*: peduncles sparsely to rather densely ± spreading-pubescent, rarely glabrous; spikes directed downwards, 6–9 cm (incl. peduncle). *Sterile flowers* in the proximal part of the spike with staminodes at first reddish violet, soon turning pale white, 1–1.5 cm long. *Fertile flowers*: calyx cup-shaped, 0.5–1 mm, with scattered ciliae or glabrous; teeth inconspicuous, c. 0.1 mm. Corolla greenish white or suffused with violet, 1.5–3 mm, glabrous, shortly connate at the base. *Stamens* 3.5–5 mm, in proximal flowers violet, in distal ones pale yellow with a light yellow gland. Ovary sessile, hairy in the distal part. *Pods* variably coiled, rigidly chartaceous, blackish, 5–7 by 0.8–1.6 cm; seeds held obliquely in the internal segments. *Seeds* light brown, glossy, subcircular in outline, biconvex, c. 4 mm in diameter, areole 2.6 by 2 mm, suborbicular; pleurogram open towards hilum, not parallel to margin. – **Fig. 30.**

Distribution – S Thailand, Australia (Northern Territory, N Queensland); in *Malesia*: Java, Madura, Lesser Sunda Islands (Flores, Lombok, Sumbawa, Wetar, Moa, Timor). Miquel (l.c., 1860) mentioned it for Sumatra.

Habitat & Ecology – Regions with a (dry) seasonal climate; on 'heavy', poor soil, in brushwood, hedges, teak forests,alang fields, thickets; altitude 0–700 m (up to 1568 m in Timor). Fl. Sep.–June; fr. Mar.–May.

Notes – I have found no evidence in the literature that this species was ever introduced from Africa. However, as judged from the very uniform specimens collected from a large area in Asia, this occurrence could be the result of a single early introduction from Africa.

## ENTADA

*Entada* Adans., Fam. 2 (1763) 318; Benth. & Hook. f., Gen. Pl. 1 (1865) 463; Benth., Trans. Linn. Soc. 30 (1875) 363; Johnston, Sargentia 8 (1949) 135; Brenan, Kew Bull. (1955) 161; *ibid.* 20 (1967) 361; Hutch., Gen. Fl. Pl. 1 (1964) 288.

*Pusaetha* O. Kuntze, Rev. Gen. Pl. 1 (1891) 204; Taubert in E. & P., Nat. Pflanzenfam. 3, 3 (1891) 122.

*Entadopsis* Britton, N. Amer. Fl. 23 (1928) 191.

Unarmed lianas or scandent shrubs (in Asia). Stipules not spinescent, inconspicuous. *Leaves* bipinnate, not sensitive to the touch, rachis and pinnae without extrafloral nec-

taries, the terminal pinnae transformed into tendrils; leaflets opposite or proximal leaflets (in one species) alternate. *Inflorescence* a pedunculate, axillary or supra-axillary spike or spiciform raceme. *Flowers* pentamerous, uniform, male or bisexual. Calyx connate, valvate. Petals valvate, free, or shortly united at the base. *Stamens* 10, free; anthers with a subsessile or stipitate caducous gland at the top of the connective. *Pods* often large, chartaceous or mostly woody, straight, curved or spirally twisted, at maturity falling apart in one-seeded segments; the exocarp separating from the endocarp, which forms envelopes containing one seed, the sutures remaining as an empty frame. *Seeds* globular, flattened or irregularly compressed, with a hard testa without areole (in Asian species), wingless, aril absent, endosperm absent; cotyledons large, radicle curved. — **Fig. 32.**

Distribution — Pantropical, with c. 30 species; in Asia 7 or 8 species, in *Malesia* 5. Fig. 31.

Habitat & Ecology — The species of *Entada*, except *E. parvifolia*, are frequently found in riverine vegetation, the segments of the pods being dispersed by water. Two species, *E. rheedii* and *E. phaseoloides*, are dispersed by sea-currents, and have been collected also behind the mangrove and in gallery forest at the limits of tidal influence. According to Ridley [Dispersal (1930) 284] only between half and two thirds of the seeds will float in freshwater, but those which are able to float can do so for at least a year due to a central cavity between the cotyledons. Ridley (l.c.) stated that the seed coat of the inland, non water-dispersed *E. spiralis* is much thinner than that of the water-dispersed species.

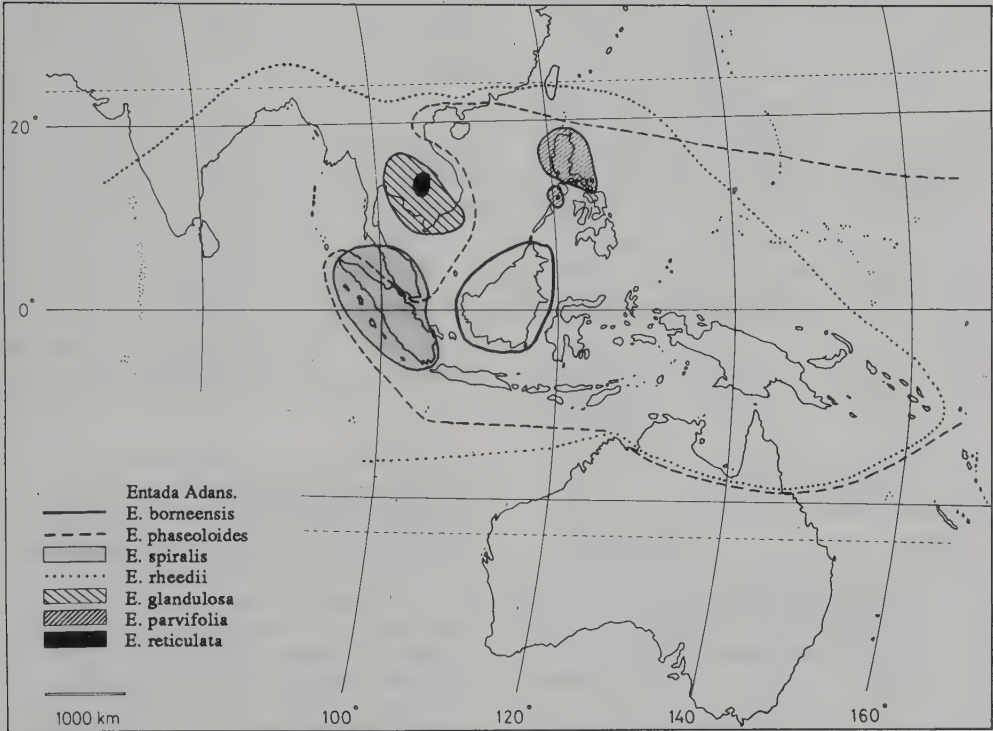


Fig. 31. Ranges of various species of *Entada* Adans.



Due to lack of field observations, we do not know much about the development and the morphology of the woody stems of *Entada*, but from the few observations available, the trunks of *E. phaseoloides* and *E. rheedii* are twisted close to the ground; in New Guinea the trunk base of *E. phaseoloides* specimens may attain a girth of 3 m. Investigations in Gabon [Catallé, *Adansonia* 20 (1981) 309–321] have shown that *E. gigas* Fawcett & Rendle, which is close to *E. rheedii*, has stems often > 30 cm in diameter, which may grow extremely quickly towards the light. In the canopy such large specimens often entangle several trees.

Taxonomy — Brenan (1967, l.c.) recognized two subgenera, viz. subg. *Entada* with 6 sections and subg. *Acanthentada* Brenan, which later on was referred to the African–South American genus *Adenopodia* Brenan [Kew Bull. 41 (1986) 73]. The Asian species *E. rheedii*, *E. spiralis*, *E. phaseoloides*, and *E. borneensis* belong to subg. *Entada* sect. *Entada* subsect. *Entada*. *Entada parvifolia* belongs to subsect. *Sphaerospermae* Brenan [Kew Bull. 20 (1967) 363] together with the Indochinese *E. glandulosa* and *E. reticulata*.

Note — The term ‘rachis’ in the description of the leaves does not cover the extension beyond the terminal pair of leaflet-bearing pinnae.

#### KEY TO THE SPECIES

- 1a. Trailing or scandent shrub with large fleshy tubers underground. Leaflets 8–11 pairs per pinna, opposite, 1.1–1.9 by 0.4–0.75 cm . . . . . **2. *E. parvifolia***
- b. Giant climbers, without fleshy tubers. Leaflets to 7 pairs per pinna, opposite or alternate, leaflets at least 1.4–4 by 0.7–1.8 cm . . . . . **2**
- 2a. All leaflets except the distal pair alternate . . . . . **1. *E. borneensis***
- b. Leaflets all opposite . . . . . **3**
- 3a. Apex of leaflets rounded to truncate, emarginate, most often glaucous beneath. Pods spirally twisted. Seeds irregularly compressed . . . . . **5. *E. spiralis***
- b. Apex of leaflets ± acuminate to obtuse, ± emarginate to bifid, not or but very rarely glaucous beneath. Pods straight or slightly curved. Seeds flat, subcircular . . . . . **4**
- 4a. Leaflets 1 (or 2) pair(s) per pinna. Pod with a parchment-like endocarp . . . . . **3. *E. phaseoloides***
- b. Leaflets 3 or 4 (or 5) pairs per pinna. Pod with a woody endocarp . . . . . **4. *E. rheedii***

**1. *Entada borneensis*** Ridley, J. As. Soc. Beng. 67, 2 (1898) 307.

Woody climber, to more than 40 m long. *Leaves*: rachis 5–9.5 cm, subglabrous- or mostly densely puberulous-tomentose; leaflets 5–7 on each side of the pinnae, only the distal pair opposite, chartaceous, obliquely narrowly obovate-elliptic-oblong, 1.4–4 by 0.7–1.8 cm, base asymmetrically rounded, apex rounded, emarginate, main vein puberulous, both surfaces glabrous or lower surface scattered patently puberulous, sometimes glaucous. *Inflores-*

*cences*: spikes 19–40 cm, rachis densely puberulous-shortly tomentose. *Flowers* with inconspicuous pedicels, yellowish white, white, or greenish white, pentamerous, male or bisexual. Calyx broadly cup-shaped 0.5–0.6 mm, glabrous; teeth inconspicuous. Petals lanceolate, c. 2 mm, acute, glabrous. *Stamens* c. 4 mm. *Pod* not seen as a whole; segments 9–10 cm long, 10–13 cm wide, epicarp coriaceous, shrinking, endocarp parchment-like. *Seeds* brown, circular in outline, flat, c. 4 cm in diameter.

Distribution — *Malesia*: Borneo. — Fig. 31.

**Habitat & Ecology** – Vigorous climber in primary and secondary rain forest, common along riversides; soil sandy clay, loam, or limestone rocks; altitude 0–800 m. Fl. Feb., Mar., July; fr. Feb.

**Note** – A common but rarely collected species.

**2. *Entada parvifolia* Merr., Philipp. J. Sc., Bot. 3 (1908) 229; *ibid.* 5 (1910) 33; Enum. Philipp. 2 (1923) 252.**

*Entada philippinensis* Gagnep., Not. Syst. 2 (1911) 58.

Scandent shrub (or possibly a subshrub) with large, fleshy tuber underground; stems terete, glabrous. *Leaves*: rachis 4–7.5 cm, glabrous; pinnae 2 pairs, 4.5–7.5 cm, glabrous; leaflets 8–11 pairs per pinna, opposite, subsessile, stalk 1 mm, chartaceous, obliquely oblong, 1.1–1.9 by 0.4–0.75 cm, base asymmetrically cuneate to half cuneate/half rounded, apex rounded, truncate, or slightly emarginate, mucronulate, glabrous. *Inflorescence*: spikes supra-axillary, c. 15 cm, appressed puberulous. *Flowers* subsessile, male or bisexual. Calyx shallow, cupular, 0.75–1 mm, glabrous or with a few scattered hairs with deltoid teeth to c. 0.1 mm. Petals oblong-linear, mucronate, c. 3 mm, glabrous. *Stamens* c. 5.5–7 mm. Ovary c. 1.5 mm, glabrous. *Pod* dark brown, oblong, straight, 29.5 by 5–5.5 cm; segments 2.3–3 cm long; epicarp rigidly chartaceous, not reticulate, endocarp whitish, thinly parchment-like. *Seeds* dark brown, irregularly ovoid, c. 1.8 by 1.6 by 0.8 cm.

**Distribution** – *Malesia*: Philippines (Luzon, Golo, Busuanga). – Fig. 31.

**Habitat & Ecology** – Thickets at low altitudes (Merrill 1923). Fl. July–Sep.; fr. Dec.

**Uses** – The stems have been used as a substitute for soap (Merrill 1923).

**Note** – This species has an growth form which is intermediate between the subshrubs *E. glandulosa* and *E. reticulata* of Indochina and Thailand and the woody lianas *E. rheedii* and *E. phaseoloides*.

**3. *Entada phaseoloides* (L.) Merr., Philipp. J. Sc., Bot. 9 (1914) 86; Inter. Rumph. (1917) 253; Enum. Philipp. 2 (1923) 252, p.p.; Docters van Leeuwen, Ann. Jard. Bot. Buitenzorg 46/47 (1936) 379; Backer & Bakh. f., Fl. Java 1 (1963) 564; Verdc., Manual New Guin. Legum. (1979) 134; Nielsen, Adansonia sér. 2, 19 (3) (1980) 342; Fl. Camb. Laos Vietnam 19 (1981) 21, pl. 3, 1; Fl. Nouv.-Caléd. et Dépend. 12 (1983) 10. — *Lens phaseoloides* L. in Stickm., Herb. Amb. (1754) 18; Amoen. Acad. 4 (1759) 128.**

*Faba marina major* Rumph., Herb. Amb. 5 (1747) 5, t. 4.

*Mimosa scandens* L., Sp. Pl. ed. 2, 2 (1763) 1501, p.p. — *Entada scandens* (L.) Benth., J. Bot. 4 (1842) 332, p.p.;

*Entada rumphii* Scheff., Nat. Tijds. Ned. Ind. 32 (1873) 90, t. 17, 18B.

Woody climber, often with flattened and spiral stem. *Leaves*: rachis c. 2 cm; pinnae 1 or 2 pairs, like the rachis glabrous to puberulous, 6.5–9 cm; leaflets 1 or 2 (or 3) pairs per pinna, rigidly chartaceous (the upper surface drying considerably darker than the lower), elliptic, obliquely elliptic, or obovate-elliptic, unequal-sided, 4.5–10 by 1.8–6.3 cm, base asymmetrical or  $\pm$  emarginate, glabrous or puberulous on midrib and margins. *Inflorescence*: a solitary spike in the leaf axils or sometimes several spikes from a short-shoot, 13–30 cm,  $\pm$  densely puberulous. *Flowers* sessile or subsessile, pentamerous, male or bisexual. Calyx green, broadly cup-shaped, glabrous, 0.8–1.25 mm; teeth inconspicuous. Petals green with a reddish base, eglandular, elliptic to lanceolate, acute, 2.8–3.5 mm. *Stamens* 6.5 mm, white, turning yellow. *Pod* straight to slightly curved, up to 1–1.35(–2) by 0.07–0.15 m; segments 6.5–7.5 cm long; epicarp woody, veins inconspicuous; endocarp parchment-like. *Seeds* brown, suborbicular, flattened, 4–6 by 3.3–5 by c. 1 cm.

**Distribution** – Mainland Asia (N Vietnam, S China), tropical Australia, Pacific area; in *Malesia*: Borneo, Sumatra, Java, Philippines, Celebes, Lesser Sunda Islands (Wetar, Flores), Moluccas (Halmahera, Ternate, Ambon, Tanimbar Is.), New Guinea (incl. Bismarck Archipelago). – Fig. 31.

**Habitat & Ecology** – Found in a wide variety of habitats, e.g. in riverine vegetation, rain forest, montane forest dominated by *Castanopsis*, freshwater swamp-forest, along inner edge of mangrove, sandy alluvium behind the sea; altitude 0–900 (–1700) m. Fl. Jan.–Nov.; fr. Jan., Sep.–Nov.; dispersed by sea-currents.

**Uses** – As of *E. rheedii*.

**Notes** – Closely related to *E. rheedii* and mixed up with that species by, e.g., Backer & Bakhuizen f. and Merrill (ll. cc.). Specimens from the Bismarck Archipelago may be difficult to identify as they have three pairs of leaflets per pinna, but they can be recognized by the terminal leaflets which tend to be asymmetric, and the always parchment-like endocarp.

According to Docters van Leeuwen (l.c.), this species occurred on Krakatau not long after the big eruption had destroyed all vegetation.

**4. *Entada rheedii*** Spreng., Syst. Veg. 2 (1825) 325; Nielsen, Fl. Thailand 4, 2 (1985) 144, f. 3: 2–6. — *Mimosa entada* L., Sp. Pl. 1 (1753) 518.

*Entada monostachya* DC., Prod. 2 (1825) 425; Mém. Leg. (1826) 422.

*Entada pursaetha* DC., Prod. 2 (1825) 425; Mém. Leg. (1826) 421; Verdc., Manual New Guin. Legum. (1979) 135; Nielsen, Adansonia sér. 2, 19 (3) (1980) 343; Fl. Camb. Laos Vietnam 19 (1981) 21, pl. 3, 2–6.

*Adenanthera gogo* Blanco, Fl. Filip. ed. 1 (1837) 353. — *Entada gogo* (Blanco) Johnston, Sargentia 8 (1949) 137.

*Entada schefferi* Ridley, J. Bot. 58 (1920) 195; Fl. Mal. Pen. 1 (1922) 654, p.p., quoad typus; Craib, Fl. Siam. Enum. 1 (1928) 543.

*Entada scandens* auct. non Benth.; Benth., J. Bot. 4 (1842) 332.

*Entada phaseoloides* auct. non (L.) Merr.: Merr., Sp. Blanc. (1918) 168, 194; Enum. Philipp. 2 (1923) 252, p.p.; Backer & Bakh. f., Fl. Java 1 (1963) 564, p.p.

Woody climber, at least 120 m long. *Leaves*: rachis (4.5–)6–8(–10.5) cm; pinnae 2 pairs, 5–15 cm, as the rachis glabrous to subglabrous; leaflets 3 or 4 (or 5) pairs per pinna, opposite, chartaceous, obovate to elliptic-lanceolate, unequal-sided, (1.4–)2.3–7 by (1–)1.3–3.5 cm, base rounded to broadly cuneate, somewhat asymmetrical, apex  $\pm$  acuminate to obtuse,  $\pm$  emarginate to nearly bifid, the upper surface usually not drying darker than the lower one, the lower surface sometimes glaucous. *Inflorescence*: spikes solitary in the leaf axils or sometimes more spikes from a short-shoot, c. 12–25 cm, rachis  $\pm$  densely puberulous. *Flowers* sessile or subsessile, pentamerous, male or bisexual. Calyx green, broadly cup-shaped, (0.5–)0.8–1 mm, glabrous or with a few scattered hairs; teeth inconspicuous. Petals white, narrowly elliptic to lanceolate, acute, eglandular, 2.8–3 mm. *Stamens* white turning yellow, 5–6.5 mm. Ovary 1–1.5 mm, glabrous, stipe 0.5 mm. *Pod* straight to slightly curved, up to 2 by 0.07–0.15 m; segments 6.5–7.5 cm; epicarp and endocarp woody. *Seeds* brown, subcircular, flat, 3.5–4 by 1 cm.

*Distribution* – Africa, Mascarene Islands, tropical Asia, Australia and a small part of the Pacific; in *Malesia*: Malay Peninsula, Java, Borneo, Celebes, Philippines (Luzon, Mindanao), Lesser Sunda Islands (Lombok, Sumbawa, Flores, Timor, Alor), Moluccas (Wetar), New Guinea. – Fig. 31.

*Habitat & Ecology* – Primary and secondary

forest, especially along rivers, behind mangrove, beach forest; altitude 0–400 m. Fl. May–Oct.; fr. Jan., Apr.–May, July–Aug., Nov. Dispersed by water and often found along rivers at the limit of the tidal influence. Probably also propagated by man.

*Uses* – Cultivated in the Malay Peninsula [cf. Burkill, Dict. (1935) 940 sub *Entada phaseoloides*]. The saponin content is considerable in bark and seeds [Boorsma, Bull. Inst. Bot. Buitenzorg 14 (1902) 20]. Used as a substitute for soap [Bisschop Grevelink, Pl. Ned. Indië (1883) 25; see also Heyne, Nutt. Pl. Ned. Ind. 2 (1916) 225, sub *E. scandens*]. Readily grown from cuttings.

*Note* – Closely related to *E. phaseoloides*, but distinct by 3 or 4 (or 5) pairs of leaflets per pinna, a woody, tough endocarp and slightly less asymmetric terminal leaflets. A sterile specimen from Celebes, *Koorders 17662*, has densely puberulous rachis and pinnae.

**5. *Entada spiralis*** Ridley, J. As. Soc. Beng. 67, 2 (1898) 305; Fl. Mal. Pen. 1 (1922) 655; Burkill, Dict. 1 (1935) 942; Nielsen, Fl. Thailand 4, 2 (1985) 142, f. 34: 1.

*Entada schefferi* auct. non Ridley; Ridley, Fl. Mal. Pen. 1 (1922) 654, p.p., quoad *Scortechini 769*, *Wallich 5293*; *King's coll. 1018*.

Woody climber, at least 25 m long; stem flattened, in a spiral. *Leaves*: rachis (4.4–)5–8.5 cm, densely puberulous to tomentose; pinnae 2 pairs, 4–9 cm, densely puberulous to tomentose; leaflets 3 or 4 pairs per pinna, opposite, chartaceous, glaucous beneath, narrowly obovate-elliptic to obovate, unequal-sided, 1.8–6.5 by 0.9–3 cm, base  $\pm$  asymmetrical, rounded to broadly cuneate, apex rounded-truncate, emarginate, glabrous. *Inflorescence*: spikes solitary in the leaf-axils, c. 15–20 cm, rachis sparsely puberulous to tomentose. *Flowers* sessile or subsessile, pentamerous, male or bisexual. Calyx green, cup-shaped, 0.5–1 mm, densely puberulous to glabrous; teeth inconspicuous. Petals white, elliptic, acute, glabrous, 2.5–3 mm. Stamens c. 6 mm, whitish green or white, turning yellow. Ovary glabrous, c. 1.5 mm, stipe 0.2–0.5 mm. *Pod* large, spirally coiled, c. 1.2–1.8 by c. 0.06 m wide, segments triangular and irregular; epicarp woody, endocarp chartaceous to parchment-like. *Seeds* brown, irregularly compressed by the segments of the pod, c. 6–6.5 by 5 by 1.5–1.8 cm. – Fig. 32.

*Distribution* – Thailand (Peninsular); in *Malesia*: Malay Peninsula, Sumatra. – Fig. 30.



Habitat & Ecology – Primary and secondary rain forest, common in secondary growth; 0–540 m. Fl. ± throughout the year; fr. Aug., Sep., Dec.

Uses – According to Burkill (l.c.), the species is, like *E. rheedii*, used mainly for its saponine content of bark and seed.

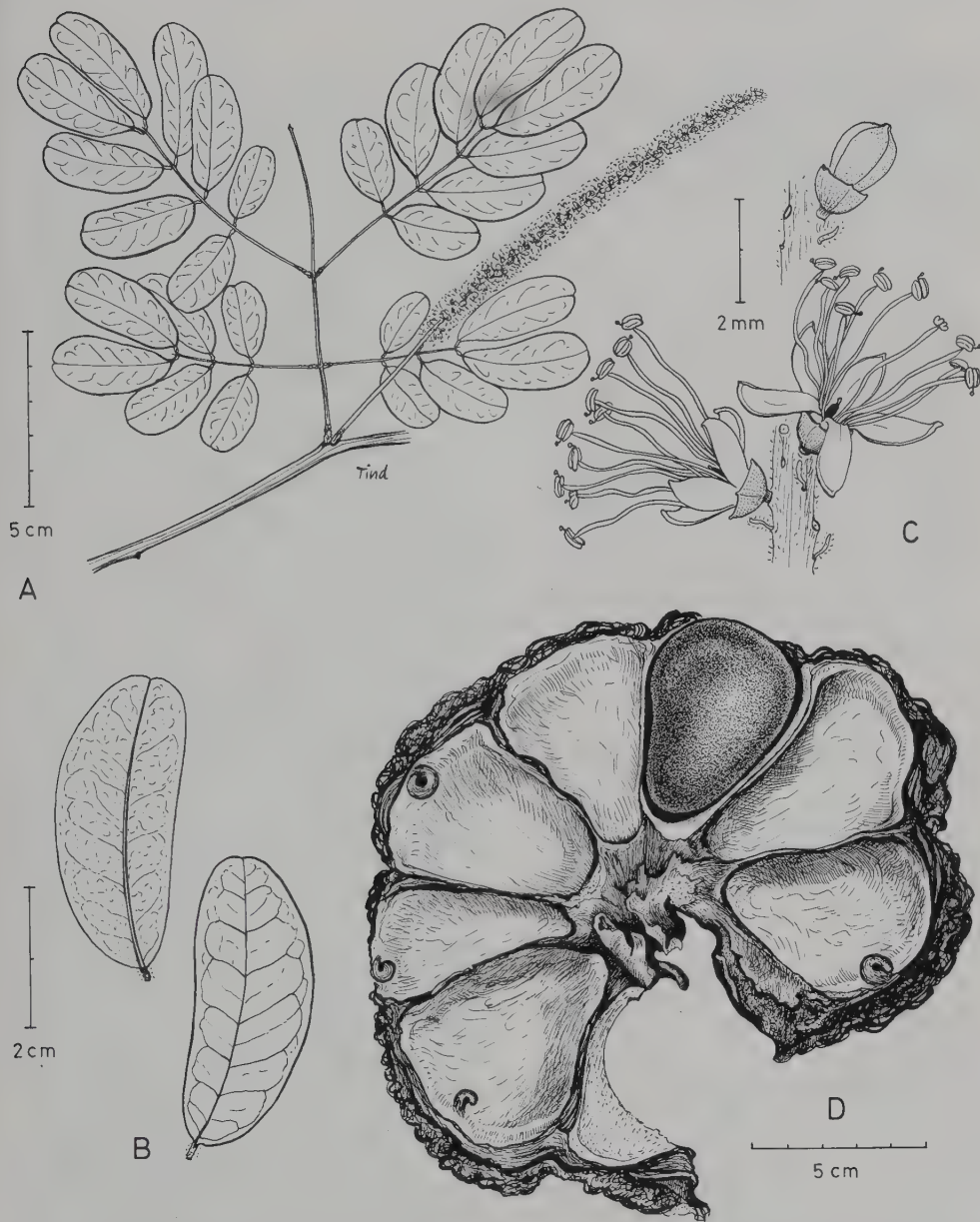


Fig. 32. *Entada spiralis* Ridley. A. Flowering stem; B. leaflet seen from below (left) and above (right); C. detail inflorescence; D. part of opened pod (A–C: Maxwell 77-121; D: Maxwell 86-164).

## LEUCAENA

*Leucaena* Benth., J. Bot. 4 (1842) 416; Benth. & Hook. f., Gen. Pl. 1 (1865) 463; Benth., Trans. Linn. Soc. 30 (1875) 442; Taubert in E. & P., Nat. Pflanzenfam. 3, 3 (1891) 115; Hutch., Gen. Fl. Pl. 1 (1964) 281.

Unarmed shrubs or trees. Stipules not spinescent, caducous. *Leaves* bipinnate, not sensitive to the touch, rachis and pinnae usually with extrafloral nectaries; leaflets opposite. *Inflorescences* composed of pedunculate glomerules, either single or a few axillary, or arranged in terminal racemes. *Flowers* pentamerous, uniform, male or bisexual. Calyx connate, valvate. Petals free, valvate. *Stamens* 10, free, anthers eglandular (hairy in *L. leucocephala*). *Pod* membranous, straight, dehiscent, exocarp not separating from the endocarp. *Seeds* brown, compressed, with areole, wingless, aril absent, endosperm present.

Distribution — About 50 species in tropical America; also outside America one species, *L. leucocephala*, is introduced, cultivated and naturalized, amongst others in *Malesia*; another species, *L. pulverulenta* (Schldl.) Benth., is rarely cultivated.

***Leucaena leucocephala* (Lam.) De Wit**, Taxon 10 (1961) 53; Backer & Bakh. f., Fl. Java 1 (1963) 560; De Wit, Taxon 24 (1975) 352; Verdc., Manual New Guin. Legum. (1979) 154; Nielsen, Fl. Camb. Laos Vietnam 19 (1981) 38, pl. 5, 21–25. — *Mimosa leucocephala* Lam., Enc. Méth. Bot. 1 (1783) 12.

*Mimosa glauca* L., Sp. Pl. ed. 2, 2 (1763) 1504, non 1753. — *Acacia glauca* (L.) Willd., Sp. Pl. 4 (1806) 1075. — *Leucaena glauca* (Willd.) Benth., J. Bot. 4 (1842) 416.

*Acacia frondosa* Willd., Sp. Pl. ed. 4, 4 (1806) 1076.

Shrub or small tree to c. 10(–15) m high; branchlets terete, at the top densely grey pubescent. *Leaves*: rachis 15–20 cm, often with an orbicular gland below the junction of the proximal pair of pinna; pinnae 3–10 pairs, 10 cm; leaflets 5–20 pairs per pinna, linear or linear-oblong, 6–21 by 1.5–5 mm, base slightly asymmetrically cuneate, apex acute or short-apiculate; both surfaces glabrous, margins ciliate, lower surface glaucous. *Inflorescences* consisting of pedunculate glomerules aggregated up to 3 in the leaf-axils or in terminal racemes; peduncles 2–5 cm, densely grey pubescent. *Flowers*: calyx tubular-campanulate, c. 2.5 mm, puberulous at the apex, teeth triangular, acute. Petals spatulate 4.5–5 mm, puberulous. *Stamens* 10, creamy white to greenish white, filaments 8–10 mm. Ovary stipitate, velutinous at the apex. *Pods* straight, 20 by 2 cm. *Seeds* 15–30, obliquely held in pod, narrowly ovate, compressed, 6–9 by 3–4.5 mm, obtuse at

the apex, cuneate at the base; areole oblong, c. 4 by 1.5 mm, open towards the hilum.

Distribution — Tropical America, introduced and naturalized in most tropical areas of the world; in *Malesia*: all over the area.

Habitat & Ecology — Locally abundant in secondary vegetation, along roadsides, in clearings, wastelands, gravelly riverbeds, etc.; altitude sea-level up to 1400 m. Fl., fr. throughout the year.

Uses — Extensively cultivated especially in areas with a tropical seasonal climate [Burkill, Dict. Econ. Prod. (1935) 135]. Cultivated as a cover-crop for control of soil erosion in the Philippines. The best development is found in well-drained, fertile soils, improved by adding calcium carbonate to the soil [5–10 tons/acre; Hill, Papua New Guinean Agric. J. 22 (1971) 69]. Widely used and recommended as food for beef cattle, dairy cows, water buffalo and goats. Because of a non protein amino acid, mimosine (c. 5% of the protein content), in the leaves, the *Leucaena* part of the diet must never exceed 1/3. Mimosine in larger amounts inhibits the production of thyroxine, and causes goitre.

Wood medium hard, used for paper pulp, plywood, poles etc., also as fuel wood and charcoal. Used for soil improvement, reafforestation, as shade plants and nurse crop for a wide range of tropical trees and crops (e.g. coffee, cocoa, tea, cinchona, mangosteen, citrus, pepper, vanilla, seedlings of teak and other forestry species, rubber, coconut and oil palm). Young leaves, flowers and fruits are used in cooking. Seeds can be used as a

substitute for coffee. The bark produces a brown dye, used for fishing-nets. For further details see Anonymus, *Leucaena*: Promising forage and tree

crop for the tropics, U.S. Nat. Acad. Sc. (1977) 115; Anonymus, Tropical legumes, Resources for the future, U.S. Nat. Acad. Sc. (1979) 131.

MIMOSA

*Mimosa* Linn., Sp. Pl. ed. 1 (1753) 516; Gen. Pl. ed. 5 (1754) 233; Benth. & Hook. f., Gen. Pl. 1 (1865) 463; Benth., Trans. Linn. Soc. 30 (1875) 388; Taubert in E. & P., Nat. Pflanzenfam. 3, 3 (1891) 115; Hutch., Gen. Fl. Pl. 1 (1964) 282; Lewis & Elias in Polhill & Raven, Adv. Leg. Syst. 1 (1981) 166; Barneby, Mem. N.Y. Bot. Gard. 65 (1991) 1–835.

Armed or unarmed perennial herbs, shrubs or small trees, often climbing or scandent, most species armed with prickles on the internodes. Stipules not spinescent, caducous. *Leaves* bipinnate, sensitive to the touch, rachis and pinnae without extrafloral nectaries, often with prickles on the rachis; leaflets opposite. *Inflorescences* consisting of pedunculate, axillary glomerules (in the introduced species), or spikes. *Flowers* tetramerous (in the introduced species), uniform, bisexual. Calyx connate, valvate. Corolla connate, valvate. *Stamens* 4–8, free; anthers eglandular. *Pods* membranous to coriaceous, straight, at maturity falling apart in one-seeded segments, in the species naturalized in Malesia leaving the sutures as an empty frame. *Seeds* flattened, elliptic, with a hard testa, with areole, wingless, aril absent, endosperm absent; cotyledons large, radicle curved.

Distribution — About 400 species in all; mainly in tropical America, but a few found in tropical Africa and Madagascar; in Asia 2 species, both indigenous to India and Pakistan; in *Malesia* 3 introduced and naturalized species.

Habitat & Ecology — The naturalized species are all weeds, often serious, found e.g. at roadsides, in villages, plantations and similar disturbed habitats. They are the most common species of the subfamily. Especially in Java *M. diplotricha* has proved to be a troublesome weed.

Uses — The introduced herbaceous species have all been used as cover-crops in other tropical areas.

KEY TO THE SPECIES

- 1a. Leaf-rachis with a straight prickle at the junction of each pair of pinnae (originally from tropical South America) . . . . . 3. *M. pigra*
- b. Leaf-rachis without a straight prickle at the junction of the pinnae, sometimes unarmed. . . . . 2
- 2a. Small trees, introduced . . . . . 3
- b. Armed (or unarmed) herbs, subshrubs or scandent shrubs. . . . . 4
- 3a. Juvenile branches and leaves covered with stellate hairs (originally from SE Brazil, locally introduced) . . . . . *M. scabrella* Benth.
- b. Juvenile branches and leaves without stellate hairs (originally from S Brazil and NE Argentina) . . . . . 1. *M. bimucronata*



- 4a. Leaves without prickles on petiole and rachis; pinnae 1 or 2 pairs, subdigitate (pan-tropical, of South American origin) . . . . . **4. *M. pudica***  
 b. Leaves  $\pm$  prickly on petiole and rachis (except for cultivar *M. diplotricha* var. *inermis*); pinnae 4–7 pairs evenly arranged along the rachis (originally from tropical America)

**2. *M. diplotricha***

- 1. *Mimosa bimucronata*** (DC.) O. Kuntze, Rev. Gen. Pl. 1 (1891) 198; Burkart, Fl. Ilus. Catarinense, Legum.-Mim. (1979) 154, f. 21.  
 — *Acacia bimucronata* DC., Prod. 2 (1825) 469.  
*Mimosa sepiaria* Benth., J. Bot. 4 (1842) 395; Ridley, Fl. Mal. Pen. 1 (1922) 656, p.p.; Burkill, Dict. Econ. Prod. Mal. Pen. 2 (1935) 1475.

Shrub or tree 8 m high; internodes armed by up to 1 cm long recurved prickles (often absent in the inflorescences), glabrous to pubescent. Stipules linear-lanceolate, to 7 mm. *Leaves*: petiole eglandular, rachis 1.5–12 cm, pubescent, mucronate; pinnae opposite, 4–9 pairs, 1.5–8 cm, pubescent; leaflets imbricate, 15–30 pairs per pinna, oblong and slightly falcate, 5–12 by 0.8–2.6 mm, subcoriaceous, base auriculate in the basiscopic and cuneate in the acroscopic portion, glabrous to puberulous, with ciliate margins; apex acute. *Inflorescences* consisting of pedunculate glomerules, aggregated into terminal panicles to 40 cm long; glomerules 1–4 together, 4–5 mm in diameter, peduncles 1–1.7 cm. *Flowers* white, scented. Calyx 0.8–1 mm, 3- or 4-toothed. Corolla 2.5–4 mm, 4-toothed, glabrous with papillose or glandular apices. *Stamens* 8, 8 mm long. Ovary initially glabrous. *Pods* with 4–8 segments, glabrous, unarmed, finely reticulate, 3–6 by 0.6–0.9 cm, chartaceous to subcoriaceous. *Seeds* ovate, olivaceous, 4.5 mm long, compressed.

Distribution – E Brazil and NE Argentina; in *Malesia* introduced; naturalized in and around Singapore and Kuching (cf. Burkill, l.c.).

Uses – Excellent bee-crop. Wood used for carpentry, firewood etc. Introduced into the Far East before 1850.

- 2. *Mimosa diplotricha*** C. Wright ex Sauvalle, Anal. Real Acad. Ci. Habana 5 (1868) 405; Barneby, Brittonia 39 (1987) 49.  
*Mimosa invis*a Mart., Flora 20, 2, Beibl. 8 (1837) 121, nom. illeg., non Mart. ex Colla (1834).

## KEY TO THE VARIETIES

- 1a. Plant with prickles . . . **a. var. *diplotricha***  
 b. Plant without prickles . . . **b. var. *inermis***

**a. var. *diplotricha***

*Mimosa invis*a auct. non Mart. ex Colla: Benth., Trans. Linn. Soc. 30 (1875) 436; Merr., Philipp. J. Sci. 14 (1919) 243; v. Hall, Teysmannia 31 (1920) 293; Heyne, Nutt. Pl. Ned. Ind. ed. 2 (1927) 718; Backer, Onkruidfl. Jav. Suiker. (1934) 270; Burkill, Dict. Econ. Prod. Mal. Penins. 2 (1935) 1498; Steenis, Trop. Natuur 28 (1939) 191, fig.; ibid. 29 (1940) 59, fig.; C. T. White, Queensl. Agric. J. 1 (1940) 1; Backer & Bakh. f., Fl. Java 1 (1963) 561; Fosb., Phytologia 15 (1968) 496; Verdc., Manual New Guin. Legum. (1979) 147; Nielsen, Fl. Camb., Laos, Vietnam 19 (1983) 34, pl. 5: 1–7; Fl. Nouv.-Caléd. et Dépend. 12 (1983) 19, pl. 3; Fl. Thailand 4, 2 (1985) 152, f. 36.

A straggling or scrambling woody shrub or semi-woody herb, with branches to 5 m long or more; stems quadrangular, hirsute, armed with four rows of recurved prickles 3–4 mm long on the internodes. *Leaves*: petiole 3–5 cm, rachis 6–11 cm, furrowed, hirsute, armed with four rows or recurved prickles and with stipellate prickles at the bases of the pinnae; pinnae 3–10 pairs, evenly distributed along the rachis, 1–4.5 cm, hirsute, with recurved prickles on the abaxial side; leaflets 11–30 pairs per pinna, oblong, acute, (2–)3.5–5(–7) by (0.8–) 1–2 mm, with scattered hairs on both surfaces. *Inflorescences* consisting of axillary, pedunculate, solitary or paired glomerules, peduncles 0.5–0.6 cm long. *Flowers* subsessile, bisexual, tetramerous. Calyx inconspicuous, 0.4 mm. Corolla narrowly funnel-shaped, 2 mm, finely puberulous; lobes ovate, obtuse, 1 mm. *Stamens* 8, with pale purple-pink filaments. Ovary c. 1 mm, inconspicuously puberulous. *Pods* borne in clusters, oblong, slightly curved 1.5–3.5 by 0.4–0.45 cm, with short, prickly bristles on margin and surface of the valves. *Seeds* yellow-brown, somewhat glossy, c. 3.5 mm.

Distribution – Tropical America, now introduced to all tropics in *Malesia*: Malaya, Sumatra, Java, Borneo, Philippines (Luzon), Lesser Sunda Islands (Flores, Timor), New Guinea, and probably spreading elsewhere.

Habitat & Ecology – Weed in plantations, road-

sides, grassland, wasteland and other disturbed habitats; in areas with a strong dry season limited to moist depressions and stream banks; 0–1650 m. Fl., fr. throughout the year.

Uses – Originally used as a cover-crop in coconut and other plantations and in tobacco-fields. Duration of growth is 1.5 to 2 years (Burkill, l.c.). Introduced to Java about 1909. Competesalang successfully. Recorded as a cattle-fodder.

Note – A serious weed. A portion of the seeds has delayed germination. Germination is also stimulated by fire, according to Van Steenis (1939, 1940); he reported that seeds in sunburnt tiles of a tennis-court during germination were able to push away fragments of the tiles, creating a tension which resulted in the fragments being thrown 5–20 cm away.

**b. var. *inermis*** (Adelb.) Veldk., Fl. Males. Bull. 9 (no 40) (1987) 416; Verdc., Kew Bull. 43 (1988) 360. — *Mimosa invisa* var. *inermis* Adelb., Reinwardtia 2 (1953) 359; Verdc., Manual New Guinea Legum. (1979) 148.

Plant without prickles.

Distribution – A mutant which originated from Java.

Habitat & Ecology – Said to be less rampant than var. *diplotricha*; altitude 0–1650 m.

Uses – Cover-crop, said to be poisonous to pigs [Van Steenis, Fl. Males. Bull. no 22 (1968) 1559], found by a Dutch planter in Central Java. Now widely cultivated.

**3. *Mimosa pigra*** L., Centuria Pl. (1755) 13; Backer & Bakh. f., Fl. Java 1 (1963) 561; Verdc., Manual New Guin. Legum. (1979) 151; Nielsen, Fl. Camb. Laos Vietnam 19 (1981) 34, pl. 5: 8–14; Barneby, Notes Roy. Bot. Gard. Edinb. 45 (1989) 129; Verdc., Taxon 38 (1989) 522. *Mimosa asperata* L., Syst. Nat. ed. 10 (1759) 1312; Miq., Fl. Ind. Bat. 1 (1855) 43.

*Mimosa sepiaria* auct. non Benth.: Ridley, Fl. Mal. Pen. 1 (1922) 656, p.p.; Burkill, Dict. Econ. Prod. Mal. Pen. 2 (1935) 1499.

Scrambling or climbing shrub to c. 4 m high. Stems terete, prickly, especially in the juvenile parts densely covered with appressed setae, shoots often with sparse foliage at the base. Leaves: petiole 0.8(–2.8) cm, rachis 3.5–17(–18) cm, slightly angular, densely hispid, with two straight spines, 0.3–1.1 cm at the junction of the pinnae; pinnae 6–14(–16) pairs, evenly distributed along the rachis, c. 3.5–4.5 cm, hispid; leaflets 20–45 pairs

per pinna, linear-oblong, with hispid margins, 5.5–8.5 by 0.8–1.1 cm, sharply acute. Inflorescences consisting of pedunculate glomerules, solitary or paired in the upper leaf-axils, peduncles c. 2 cm long, hispid. Flowers sessile, bisexual, tetramerous. Calyx scarious, tubular at the base, densely laciniate in the distal portion, 1 mm. Corolla funnel-shaped, 3 mm, tube glabrous; lobes ovate-elliptic, acute, c. 1.2 mm, glabrous towards the base, hirsute at the apex. Stamens 8, filaments pink. Ovary 1.5 mm, densely velutinous. Pods clustered, straight, linear-oblong, c. 6 by 1 cm, beaked, densely scabrous; segments 2–3 mm. Seeds grey-brown, oblong, biconvex, 5–5.5 by 2.5 mm.

Distribution – Tropical South America, but now pantropical and spreading rapidly in tropical Asia; in Malesia recorded from Sumatra, Java, New Guinea.

Habitat & Ecology – Weed along roadsides, in sandy riverbeds, on dikes, swampy localities, waste places; altitude 0–900 m. Fl., fr. throughout the year.

Note – The glomerules are covered by thick, acroscopic hairs. Already in 1855 naturalized in Java; now a serious weed. Verdcourt (1989) proposed to conserve the name of this very widespread species [against *M. pellita* Humb. & Bonpl. ex Willd., that was proposed as the legal name for the species by Barneby (l.c.)]. The present treatment follows that proposal.

**4. *Mimosa pudica*** L., Sp. Pl. ed. 1 (1753) 518; Willd., Sp. Pl. ed. 4, 4 (1806) 1032; Brenan, Kew Bull. (1955) 184; Backer & Bakh. f., Fl. Java 1 (1963) 561; Verdc., Manual New Guin. Legum. (1979) 148; Nielsen, Fl. Camb. Laos Vietnam 19 (1981) 35, pl. 5, 15–2; Fl. Nouv.-Caléd. et Dépend. 12 (1983) 20; Fl. Thailand 4, 2 (1985) 152.

*Mimosa asperata* Blanco, Fl. Filip. (1837) 732; ed. 2 (1845) 505; ed. 3, 3 (1879) 134, non L.

Annual or perennial, sometimes subshrubby herb, erect to scrambling, sometimes rooting at the nodes, up to 1 m high; stems glabrous to densely hispid, armed by recurved prickles. Leaves subdigitately pinnate, petiole furrowed, hispid, (2.5–)3–5.5 cm, without prickles at the junctions of the pinnae, but sometimes with some recurved prickles in between; pinnae 2 pairs, rachis furrowed, (1.5–)2.5–6(–7) cm, hirsute; leaflets 12–25 pairs per pinna, oblong to subfalcate, 6–15 by 1.2–3 mm, upper surface glabrous, lower slightly hispid, margins setulose. Inflorescences consisting

of axillary, pedunculate, solitary or paired glomerules. *Flowers* sessile, bisexual, tetramerous, lilac, pink or bluish purple. Calyx inconspicuous, c. 0.1 mm. Corolla narrowly campanulate, 1.9–2.3 mm; lobes broadly ovate-oblong, 0.5–0.8 mm, obtuse to rounded at the apex. *Stamens* 4. Ovary glabrous, 0.3–0.6 mm. *Pods* clustered, straight, oblong, 1.5–1.8 by 0.4 cm, densely setose, prickly on the margins only. *Seeds* light brown, suborbicular to broadly elliptic, flattened, 2.5–2.9 by 2–2.3 mm.

Distribution – Pantropical weed of South American origin. The three varieties are all found in *Malesia*.

Habitat & Ecology – Weed at roadsides, in pastures, plantations, by far the most frequent member of the subfamily in *Malesia*; altitude 0–1000 m. Fl., fr. throughout the year.

Uses – Used as cover-crop at roadsides in Thailand; roots used medicinally in the Philippines; contains tannins.

Note – The leaves are extremely sensitive to the touch.

#### KEY TO THE VARIETIES

- 1a. Corolla, even in bud, ± densely greyish puberulous in the distal part . . . . . 2
- b. Corolla outside glabrous or almost so, even in bud . . . . . **c. var. unijuga**
- 2a. Glomerules in bud either without projecting setiform hairs, or hairs few and short (to c. 0.7 mm). Stipules 4–8 (rarely 10) mm  
  - b. var. tetrandra**
  - b. Glomerules in bud appearing ± densely bristly by setiform hairs projecting beyond the corolla for 1–1.5 mm. Stipules 8–14 mm  
    - a. var. hispida**

**a. var. hispida** Brenan, Kew Bull. (1955) 186; Nielsen, Fl. Camb. Laos Vietnam 19 (1981) 36; Fl. Nouv.-Caléd. et Dépend. 12 (1983) 22; Fl. Thailand 4, 2 (1985) 154.

Stipules 8–14 mm. Young glomerules ± densely bristly by setiform hairs projecting beyond the corolla for 1–1.5 mm.

Distribution – Pantropical, in *Malesia*: Malaya, Sumatra, Java, Borneo, Philippines, Celebes, Lesser Sunda Islands (Timor), Moluccas (Ceram).

Habitat & Ecology – As the species; altitude 0–925 m.

**b. var. tetrandra** (Humb. & Bonpl. ex Willd.) DC., Prod. 2 (1825) 426; Verdc., Manual New Guin. Legum. (1979) 151; Nielsen, Fl. Camb. Laos Vietnam 19 (1981) 36; Fl. Nouv.-Caléd. et Dépend. 12 (1983) 23; Fl. Thailand 4, 2 (1985) 154. — *Mimosa tetrandra* Humb. & Bonpl. ex Willd., Sp. Pl. ed. 4, 4 (1806) 1032.

Stipules 4–8(–10) mm. Young glomerules with a lax indumentum of short hairs, extending beyond the corolla to 0.7 mm, or not. Corolla, at least in bud, densely grey puberulous in the distal part.

Distribution – Pantropical; in *Malesia*: Malaya, Sumatra, Borneo (Sabah, Sarawak), Riouw Archipelago, Philippines (Luzon), Moluccas (Ambon), New Guinea, Bismarck Archipelago (New Britain).

Habitat & Ecology – As the species; altitude 0–720 m.

**c. var. unijuga** (Duchass. & Walp.) Griseb., Abh. Kön. Ges. Wiss. Götting. 7 (1857) 211; Verdc., Manual New Guin. Legum. (1979) 151; Nielsen, Fl. Camb. Laos Vietnam 19 (1981) 56; Fl. Nouv.-Caléd. et Dépend. 12 (1983) 23; Fl. Thailand 4, 2 (1985) 154. — *Mimosa unijuga* Duchass. & Walp., Linnaea 23 (1850) 744.

Stipules 4–7(–8) mm. Corolla outside glabrous or almost so, even in bud.

Distribution – Pantropical; in *Malesia*: Malaya, Borneo (Brunei), New Guinea, Bismarck Archipelago (New Britain, New Ireland).

Habitat & Ecology – As the species; altitude 0–60 m.

## NEPTUNIA

*Neptunia* Lour., Fl. Cochinch. (1790) 653; Benth. & Hook. f., Gen. Pl. 1 (1865) 463; Benth., Trans. Linn. Soc. 30 (1875) 383; Taubert in E. & P., Nat. Pflanzenfam. 3, 3 (1891) 118; Hutch., Gen. Fl. Pl. 1 (1964) 291; Windler, Austral. J. Bot. 14 (1966) 379.

Unarmed terrestrial or aquatic herbs. Stipules not spinescent. *Leaves* bipinnate, sensitive to the touch, rachis with or without extrafloral nectaries, pinnae eglandular; leaflets opposite. *Inflorescences* consisting of a pedunculate, solitary, axillary, elliptic glomerule,



with bisexual flowers in the distal part, and sterile flower with  $\pm$  elongated staminodes at the base. Calyx connate, with 5 valvate teeth. Petals 5, free or  $\pm$  fused at the base. *Stamens* 10, free, all fertile in the bisexual flowers; anthers with or without a small caducous gland at the top. *Pods* fascicled, membranous to subcoriaceous, flattened, straight, dehiscent, endocarp not separating from the exocarp. *Seeds*  $\pm$  flattened, brown, with a hard brown testa with pleurogram.

Distribution — 11 species in the tropics of the Old and New World, 5 in Asia; in *Malaysia* 4 species.

Habitat & Ecology — Open grassland and damp places; one species, *N. oleracea*, is usually aquatic.

Note — A poorly collected genus. The sterile flowers are different within the heads; the distal ones are larger, with rudimentary anthers at the top of the staminodes.

KEY TO THE SPECIES

- 1a. Fertile flowers with 10 stamens (Section *Neptunia*) . . . . . 2
- b. Fertile flowers with 5 stamens (Section *Pentanthera* Windler). . . . . 4
- 2a. Spike globoid in bud, consisting of less than 25 flowers; peduncle 3–4.5(–5.9) cm long, bracts absent. Stipules less than 5 mm long. Lateral veins of leaflets raised and reticulate . . . . . **3. *N. javanica***
- b. Spike obovoid in bud, consisting of c. 30 flowers; peduncles usually more than 4.5 cm long, provided with bracts. Stipules more than 5 mm long. Lateral veins of leaflets obscure . . . . . 3
- 3a. Stems branched, usually erect or ascending. Leaves with a reduced gland between or just below the lowest pair of pinnae. Seeds 8–20 per pod. Leaflets frequently more than 20 pairs per pinna. Tropical and subtropical America, introduced to the Malay Peninsula . . . . . *N. plena* (L.) Benth.
- b. Stems rarely branched, usually free floating. Leaves with glands. Seeds 4–8 per pod. Leaflets 20 pairs or less per pinna . . . . . **4. *N. oleracea***
- 4a. Pods 1- (or 2-)seeded. Peduncles less than 4.5 cm long; the spikes 35–55-flowered, bracts persistent. Ovary usually white haired . . . . . **1. *N. dimorphantha***
- b. Pods 1-seeded. Peduncles usually longer than 4.5 cm; the spikes with less than 35 flowers (frequently less than 25), bracts often deciduous before flowering. Ovary glabrous . . . . . **2. *N. gracilis***

**1. *Neptunia dimorphantha*** Domin, Bibl. Bot. 39 (1926) 802; Windler, Austral. J. Bot. 14 (1966) 416, f. 21; Lavaleye & Veldkamp, Blumea 22 (1975) 168.

Perennial terrestrial herb, prostrate or weakly ascending. Taproot thick, becoming woody. Stems to 0.6 m, terete, angled when young, glabrous or pubescent. Stipules persistent, membranous, lanceolate, acuminate, base obliquely cordate, 5.5–9.6

by 2–3.9 mm, glabrous or pubescent, margin sometimes sparsely ciliate. *Leaves*: petiole 0.5–1.5 cm, angled, glabrous or pubescent, usually with a conspicuous gland, rachis angled, occasionally bearing a conspicuous gland just below each pair of pinnae; pinnae 2–4(–6) pairs, 2–4.6 cm; leaflets 7–25 pairs per pinna, oblong, obtuse or broadly acute, sometimes mucronulate, asymmetrical, 4–11.5 by 1–2.7(–3.5) mm, surfaces glabrous or pubescent, appearing minutely punctate,

margins minutely ciliate (or not), lateral veins raised, reticulate. *Inflorescence*: peduncles 1.3–4 (–4.5) cm, glabrous or pubescent, with two bracts in the lower half (occasionally a third, much smaller one in the upper half); spikes globoid to nearly ellipsoid in bud, 35–55-flowered. *Lower flowers* sterile: calyx campanulate, green, 0.6–1 mm; teeth acute, 0.2–0.3 mm; petals elliptic, 1.3–2.1 mm; staminodes (3–)5, oblong, yellow, 6–9.2 mm. *Upper flowers* bisexual: calyx campanulate, green, 0.9–1.4 mm, teeth acute, 0.3–0.5 mm; petals elliptic, green, 1.6–2.2 mm; stamens (3–)5, free, white, 2.8–3.4 mm; anthers yellow, eglandular; ovary 0.6–0.8 mm, stipitate, usually pubescent. *Pod* brown, ovoid, flat, membranaceous or coriaceous, pubescent, dehiscent at the margins, 7.1–10 by 5.5–7 mm, stipe 1.5–3 mm, longer than the persistent calyx. *Seeds* 1 (or 2) per pod, dark brown, orbicular, compressed, 3–3.9 mm by 2.6–3 mm; areole c. 2 by 1 mm, open towards the hilum.

*Distribution* – A large part of Australia; in *Malesia*: Timor.

*Note* – Only known from one collection, *Cinatti s. n.* (L) (cf. Lavaleye & Veldkamp, l.c.).

**2. *Neptunia gracilis* Benth.**, J. Bot. 4 (1842) 355; Windler, Austral. J. Bot. 14 (1966) 413; Lavaleye & Veldk., Blumea 22 (1975) 168; Verdc., Manual New Guin. Legum. (1979) 145, f. 37.

*Neptunia depauperata* Merr., Philipp. J. Sc., Bot. 13 (1918) 16; Enum. Philipp. 2 (1923) 251.

Perennial, terrestrial, prostrate or weakly ascending herb; all parts pubescent or nearly glabrous. Taproot thick, becoming woody. Stems to 0.45 m, terete, angled when young. Stipules persistent, lanceolate, acuminate, membranaceous, 4.5–9 by 1.5–3 mm, faintly nerved; margins  $\pm$  ciliate. *Leaves*: petiole 0.8–3 cm, angled, glandless or with an obscure gland at the junction of the proximal pair of pinnae; rachis angled, without glands; pinnae 2–4 (–6) pairs, winged, pubescent or sparsely ciliate; leaflets 7–22 pairs per pinna, oblong, obtuse, broadly acute or occasionally mucronulate, asymmetrical, 3.5–11.1 by 0.8–2.6 mm, minutely ciliate on the margin, the surface appearing minutely punctate, venation raised, reticulate. *Inflorescence*: peduncles 4–13.5 cm, usually with two bracts, 3–7.1 mm, distributed evenly along the axis, caducous; spikes globoid in bud, 15–35-flowered. *Lower flowers* sterile: calyx green, campanulate, 0.7–1.2 mm; teeth acute 0.2–0.4 mm; petals green, elliptic, 1.6–2.6 mm; staminodes yellow, 1.5–12 mm. *Upper flowers* bisexual: calyx

green, campanulate, 1–1.9 mm; teeth acute, 0.3–0.6 mm, ciliate or entire; petals green, 1.8–3.1 mm; stamens white, 3.9–5, anthers exserted, yellow, 0.7–0.9 mm; ovary 1–1.3 mm, glabrous. *Pod* reddish brown-crimson, oblong, flat, membranaceous to coriaceous, glabrous or with sparse short pubescence, dehiscent at the margins, 1.5–2.3 by 0.5–0.8 cm, rounded to the stipe. *Seeds* 3–8 per pod, brown, ovoid-orbicular, compressed 4–4.1 by 3.4–3.5 mm, areole open towards the hilum.

*Distribution* – A large part of Australia; in *Malesia*: Philippines (Luzon), Lesser Sunda Islands (Flores, Timor), New Guinea (Papua New Guinea).

*Habitat & Ecology* – In grasslands, at roadsides, rare; altitude 0–600 m. Fl., fr. Nov., Mar.

*Note* – Until now only known from 8 collections in *Malesia*. All belong to forma *gracilis*. Another forma, *glandulosa* Windler, is endemic to Australia (Windler, l.c.: 416).

**3. *Neptunia javanica* Miq.**, Fl. Ind. Bat. 1 (1855) 51; Backer & Bakh. f., Fl. Java 1 (1963) 562; Nielsen, Fl. Camb. Laos Vietnam 19 (1981) 26, pl. 4: 1–6; Fl. Thailand 4, 2 (1985) 148.

*Neptunia triquetra* auct. non (Vahl) Benth.: Gagnep., Fl. Gén. Indo-Chine 2 (1913) 60; Craib, Fl. Siam. Enum. 1, 3 (1928) 545.

*Neptunia acinaciformis* auct. non (Span.) Miq.: Windler, Austral. J. Bot. 14 (1966) 393, f. 6.

Prostrate perennial herb; taproot slender, becoming woody. Stems annual, up to 1 m, terete, compressed or angled when young, sparsely pubescent to glabrous. Stipules persistent, membranous, lanceolate, 2–4 by 0.9–1.5 mm, base obliquely cordate, apex acuminate, caudate, glabrous. *Leaves*: petiole 0.4–0.8 cm, angled or winged, glabrous or sparsely pubescent, gland usually present in the lower 3/4, circular in outline, inconspicuous, less than 1 mm in diameter; rachis 0.9–2.3 cm, angled, prolonged into a leaf-like projection; pinnae 2 or 3 pairs, winged; leaflets 6–17 pairs per pinna, oblong, obtuse to broadly acute, asymmetrical, 2.5–6.1 by 0.9–2 mm, glabrous, margins usually ciliate, surface appearing minutely punctate, lateral veins raised, reticulate (but sometimes indistinct). *Inflorescence* with peduncle 3–4.5 (–5.9) cm, bracts absent; spike short, globular in bud, 8–20-flowered. *Lower flowers* sterile: calyx campanulate, 5-lobed, green, 0.8–1.3 mm; teeth 0.4–0.7 mm, acute; petals 5, free, 1.6–2.6 mm, green; stamens 10, yellow, sterile, petal-like, 3.8–8 by 0.3–0.5 mm, exserted. *Upper flowers* bisexual,

pentamerous; calyx campanulate, 1.8–2.2 mm, green; teeth acute, 0.4–0.8 mm; petals green, free or coalescent at the margins, 2.9–3.5 mm; stamens 10, 5.3–6.1 mm; filaments slender, white; anthers yellow, 0.7–1 mm, lacking a terminal gland; ovary 1.4–1.8 mm, glabrous, stipitate, style slender. *Pod* subfalcate to falcate, membranous to coriaceous, glabrous, dehiscent along one margin only, 3–4.5 by 0.7–0.8 cm, acuminate at each end, stipitate, stipe 3.8–8 mm. *Seeds* (5–)10–16 per pod, situated obliquely on the pod, brown, obovoid, compressed, 3.8–4.8 by 2.5–2.7 mm, areole narrow, open towards the hilum.

**Distribution** – Thailand, Cambodia; in *Malesia*: Java (including Madura), Lesser Sunda Islands (Flores).

**Habitat & Ecology** – Salty mudplains, grassy fields on heavy clay, at low altitudes up to 650 m; locally common, but collections few. Fl., fr. Dec.–June.

**Note** – Windler (l.c.) used the name *Neptunia acinaciformis* (Span.) Miq. for this species, based on *Desmanthus acinaciformis* Span. [Linnaea 15 (1841) 198] on material from Timor. I have not been able to trace a Spanoghe specimen nor the 'Icon. no. 60' that is cited in the protologue. Benthams [in J. Bot. 4 (1842) 356] mentions the name in a note under *Neptunia gracilis*. I agree that these two taxa could be conspecific. However, as the description is ambiguous and as both *N. dimorphantha* and *N. gracilis*, unlike *N. javanica*, are found in Timor, the name *Neptunia acinaciformis* is discarded as dubious.

**4. *Neptunia oleracea*** Lour., Fl. Cochinch. (1790) 654; Backer & Bakh. f., Fl. Java 1 (1963) 562; Windler, Austral. J. Bot. 14 (1966) 401; Kosterm., Ceyl. J. Sci., Biol. Sci. 13 (1979) 257; Nielsen, Fl. Camb. Laos Vietnam 19 (1981) 27, pl. 4: 4–13; Fl. Thailand 4, 2 (1985) 146.

*Mimosa natans* L. f., Suppl. Pl. (1781) 439, nom. confus. — *Desmanthus natans* (L. f.) Willd., Sp. Pl. ed. 4, 4 (1806) 1044; W. & A., Prod. 1 (1834) 270, p.p. — *Neptunia natans* (L. f.) Druce, Bot. Soc. Exch. Club Brit. Isles (1917) 637; Backer & Bakh. f., Fl. Java 3 (1968) 650, p.p.

*Mimosa prostrata* Lam., Enc. Méth., Bot. 1 (1783) 10, nom. inval. — *Neptunia prostrata* (Lam.) Baill., Bull. Soc. Linn. Paris 1 (1833) 356.

Perennial, aquatic, floating herb, rooting at the nodes, or suberect rooted herb of damp sites. Stems up to 2.5 m long, fistulose, cylindrical, producing

when aquatic aerenchymatous tissue between the nodes and adventitious roots at the nodes. Stipules (usually not evident in floating specimens) membranous, lanceolate, base obliquely cordate, apex acuminate, 5.5–15 by 3–5 mm, glabrous. *Leaves*: petiole 2–6.8 cm, angled, glabrous, glandless, rachis prolonged into a leaf-like projection; pinnae 2 or 3 (or 4) pairs, distinctly winged, glabrous to sparsely ciliate; leaflets 8–20 pairs per pinna, oblong, obtuse to broadly acute, occasionally mucronulate, asymmetrical, 5–18 by 1.5–3.5 mm, glabrous or sparsely ciliate on the margins, the surface appearing minutely punctate, main vein visible, lateral veins obscure. *Inflorescence*: peduncles 5–20(–30) cm, erect or slightly nodding, glabrous, usually with two bracts subtending the spike; spike obovoid in bud, 30–50-flowered. *Lower flowers* sterile: calyx campanulate, 0.9–1.5 mm, teeth broadly acute, 0.3–0.5 mm; petals green, elliptic, 2.2–3.5 mm; staminodes petal-like, yellow, 7–16 by 0.5–1 mm. *Upper flowers* bisexual: calyx campanulate, green, 2–3 mm, teeth broadly acute, 0.4–0.7 mm; petals free or slightly coalescent at the margins, green, elliptic, 3–4.3 mm; stamens 10, white, with yellow anthers, 6–8.9 mm, glandless; ovary 1.2–2 mm, sessile, glabrous. *Pod* brown, broadly oblong, flat, membranous or coriaceous, glabrous, dehiscent at the margin, 1.9–2.8 by 0.8–1 cm, with the body usually at a right angle to the stipe, the latter 0.4–0.8 cm, longer than the persistent calyx. *Seeds* 4–8 per pod, obovoid, compressed, 4–5.1 by 2.7–3.5 mm.

**Distribution** – Tropics of both hemispheres, origin uncertain; in *Malesia* collected in Malaya, Sumatra, Java, Borneo, Celebes, Philippines (Mindanao), Moluccas (Buru).

**Habitat & Ecology** – Pools, ditches, canals, and places with stagnant water; rare, but locally numerous; when growing on drier ground, the stems do not develop the white, spongy tissue seen in the free floating forms. The species is also protected and cultivated. Altitude 0–c. 200 m.

**Notes** – The names *natans* and *prostrata* are both older than *oleracea*, but as they are dubious and invalid, respectively, they have been discarded.

Backer & Bakhuizen f. [Fl. Java 3 (1968) 650] followed Druce (l.c.), who named this species *Neptunia natans*, with as type specimen *Koenig s.n.* in Herb. Linn., no 1228/4, a terrestrial plant with roots, the spikes globular and the stipules small, less than 4 mm. The pod is not bent at a right angle to the stipe and not longer than the persistent calyx. For further details see Kostermans (l.c.).

**Uses** – Young stems are used as a vegetable.



## DUBIOUS NAMES

*Desmanthus trispermus* Span., Linnaea 15 (1841) 198.

This is a nomen nudum as the only text (in Dutch) known is: "301. *D. trispermus* Span. Icon. nr. 61. Verzonden met de tekening, doch de beschrijving is verloren geraakt. De plant is gevonden in het gebergteland van Oyniesoe, op Timor ..." The drawing by Spanoghe was not published.

*Neptunia acinaciformis* (Span.) Miq., Fl. Ind. Bat. 1 (1855) 51; Windler, Austral. J. Bot. 14 (1966) 393, p.p., excl. *N. javanica* Miq. — *Desmanthus acinaciformis* Span., Linnaea 15 (1841) 198.

No type material, either specimen or drawing, has been traced of this species, which was described by Spanoghe from Timor. Windler (l.c.) referred it to *N. javanica*, but the latter species has not been found in Timor, and has more seeds per pod than the 4 or 5 mentioned in the protologue of Spanoghe. *Neptunia gracilis*, which is found in Timor (see above) has 3–8 seeds per pod, but the pods of this species are not falcate-ensiform, as those originally described for *N. acinaciformis*. As mentioned by Bentham [in J. Bot. 4 (1842) 356] it is probably the oldest name for *N. gracilis*, but as the type material has not been localized, and the description is ambiguous, the name is regarded as dubious.

## SCHLEINITZIA

*Schleinitzia* Warb. ex Guinet, Trav. Sci. Tech. Inst. Fr. Pondichéry 9 (1969) 33; Verdc., Kew Bull. 32 (1977) 231; Nevling & Niezgoda, Adansonia sér. 2, 18 (3) (1978) 356; Verdc., Manual New Guin. Legum. (1979) 158; Lewis & Elias in Polhill & Raven, Adv. Leg. Syst. 1 (1981) 167.

*Leucaena* auct. non Benth.: Benth., Lond. J. Bot. 5 (1846) 94, quoad *L. forsteri* Benth. *Piptadenia* auct. non Benth.: Warb., Bot. Jahrb. 13 (1891) 453, quoad *P. novoguineensis* Warb.

*Prosopis* auct. non L.: Breteler, Acta Bot. Neerl. 9 (1960) 398.

Unarmed trees or shrubs. Stipules not spinescent, filiform, persistent. *Leaves* bipinnate, sensitive to the touch; rachis and pinnae with extrafloral nectaries; leaflets opposite. *Inflorescences* consisting of pedunculate glomerules aggregated into axillary clusters of 1–5 in the distal leaf-axils; peduncles with ring of bracts just below the glomerules. *Flowers* usually pentamerous, uniform, bisexual or male by abortion. Calyx connate, valvate, with 5 teeth. Petals 5(–7), free. Stamens (8–)10, free, or filaments loosely coherent at the base; anthers with a stipitate gland at the apex of the connective. *Pods* rigid, parchment-like, straight or slightly curved, indehiscent or very tardily dehiscent, but always splitting along the margins, endocarp not separating from the exocarp. Seeds brown, biconvex, with areole, wingless, aril absent, endosperm present. — **Fig. 33.**

**Distribution** — In total 4 species, in the Pacific area 1 species in Micronesia (Guam) and 1 from the New Hebrides to Tahiti; in *Malesia*: 2 species.

**Habitat & Ecology** — Mostly recorded from littoral habitats, especially from calcareous soil. There are no data on the mode of dispersal, but Nevling & Niezgoda (l.c.) suppose dispersal by the native people.

**Taxonomy** — The taxonomic relationships of this genus were discussed by Verdcourt (1977) and Nevling & Niezgoda (l.c.). It is closely related to *Leucaena*, but differs by its glandular anthers and the seeds held transversely in the pods (with its peculiar mode of dehiscence). The pollen is different from *Leucaena* too, being arranged in tetrahedral

tetrads, with individual tricolporate or porate grains, the apertures arranged in an inter-radial position, exine rugulate or granular.

For further notes on the history of *Schleinitzia*, see Guinet (l.c.), Nevling & Niezgoda (1978), and Verdcourt (1977).

#### KEY TO THE SPECIES

- 1a. Stipules deltoid, acute, c. 1 mm long; petiolar gland crater-shaped, up to 9 mm long and 5 mm high ..... **1. *S. megaladenia***
- b. Stipules filiform, 1–4.5 mm long; petiolar gland 0.5–1.5(–3.5) mm in diameter ..... **2**
- 2a. Petiolar gland at about the middle of the petiole ..... **2. *S. novoguineensis***
- b. Petiolar gland situated at the insertion of the proximal pair of pinnae. Vanuatu (S part) (see note under *S. novoguineensis*) ..... *S. insularum* (Guill.) Burk.

**1. *Schleinitzia megaladenia*** (Merr.) Guinet & Nielsen, *Adansonia* sér. 2, 20 (2) (1980) 166. — *Albizia megaladenia* Merr., Philipp. J. Sc., Bot. 13 (1918) 16; Enum. Philipp. 2 (1923) 247.

Small tree to 8 m high; branchlets terete, glabrous. Stipules deltoid, acute, c. 1 mm. *Leaves*: rachis 8–14 cm, puberulous, petiole 2.5–3.5 cm, glands c. 1 mm below the proximal pair of pinnae and at the three proximal pairs of pinnae, or absent; lower gland crater-shaped, hollow, up to 9 by 5 mm; distal glands narrowly urceolate, hollow, 1.5–3.5 mm in diameter, 2–4 mm high; pinnae 5–9 pairs, 5–15 cm, puberulous adaxially; leaflets (13–)20–31 pairs per pinna, asymmetrically oblong, (3–)7–15 by 1.5–4 mm, base asymmetrically cuneate/truncate, apex rounded, glabrous on both surfaces, margins ciliate, main vein closer to but not parallel to the front margin, 1 (or 2) accessory veins arching from the base towards the back margin. *Inflorescence* consisting of pedunculate glomerules aggregated into terminal racemes, 16–25 cm long, faintly appressed-puberulous; peduncles 1.5–1.7 cm; glomerules of c. 40 flowers, each flower subtended by a 1–1.5 mm long, spatulate bract. Calyx funnel-shaped, glabrous; lobes broadly deltoid, somewhat unequal, obtuse, c. 2 mm long. Petals oblanceolate, acute, glabrous, c. 2 mm long. *Stamens* 10, filaments c. 4.5 mm long, anthers with a stipitate globular gland c. 0.05 mm in diameter at the apex of the connective. Ovary subsessile, glabrous, stipe c. 1.3 mm long. *Pod* dark brown, straight, oblong with parallel margins, chartaceous, up to 8.6 by 1.6 cm, valves with reticulate veins, glabrous, indehiscent. *Seeds* obovate-elliptic, flat, c. 4.2 by 2.5 mm; areole 2.8

by 1.3 mm, with pleurogram parallel to the margin and open towards the hilum.

Distribution – *Malesia*: Philippines (Luzon).

Habitat & Ecology – Damp forests at low altitudes.

**2. *Schleinitzia novoguineensis*** (Warburg) Verdc., Kew Bull. 32 (1977) 233; Nevling & Niezgoda, *Adansonia* sér. 2, 18 (3) (1978) 357; Verdc., *Manual New Guin. Legum.* (1979) 158. — *Piptadenia novoguineensis* Warb., Bot. Jahrb. 13 (1891) 453. — *Prosopis insularum* (Guill.) Breteler subsp. *novoguineensis* (Warb.) Breteler, Acta Bot. Neerl. 9 (1960) 402. *Schleinitzia microphylla* Warb., Bot. Jahrb. 13 (1891) 336.

#### KEY TO THE VARIETIES

- 1a. Leaflets with ciliate margins only  
**a. var. *novoguineensis***
- b. Leaflets sparsely to densely pubescent all over  
**b. var. *pubescens***

#### **a. var. *novoguineensis***

Tree, 4.5–25(–30?) m high, bole 2.4–10 m, d.b.h. 10–27 cm; branchlets and leaf-rachises densely pubescent. Stipules filiform, c. 1–4.5 mm. *Leaves*: rachis 11–20 cm, petiole 2–3.8 cm, petiolar gland at about the middle of the petiole, cupular, 0.5–1.5(–3.5) mm; pinnae (13–)17–24(–30) pairs, 2.5–4 cm; leaflets (25–)40–50(–65) pairs per pinna, oblong, 2–5(–6) by 0.5–1(–2) mm, base asymmetrically truncate, apex rounded, surfaces glabrous, margins ciliate, main vein not parallel to the front margin; lateral veins inconspicuous.



Fig. 33. *Schleinitzia novoguineensis* (Warb.) Verdc. var. *novoguineensis*. A. Habit; B. stipule and leaf base; C. detail of rachis with extrafloral nectary; D. leaflets seen from above (left) and below (right); E. glomerule in bud; F. cluster of juvenile pods; G. dehiscent ripe pod; H. flower and bract; I. seed (A–E, G–I: Brass 28026; F: Kalkman BW 3709).



ous. *Inflorescences* composed of axillary pedunculate glomerules of c. 80–120 flowers, c. 1 cm in diameter, peduncle 1.5–2.5 cm, flowers subtended by peltate bracts, 1.5 mm. Calyx narrowly funnel-shaped, 1.5–1.7 mm, glabrous; teeth 0.2–0.3 mm, deltoid, with a few scattered hairs towards the apex. Petals pink to violet or green, narrowly elliptic to oblong, 1.7–2.2 by 0.5 mm, acute, glabrous. *Stamens* light purple with yellow anthers, c. 6 mm. Ovary c. 1–1.5 mm, glabrous, or absent. *Pod* red-brown or black, straight, thinly woody, with flaking epicarp, oblong, (3.5–)4.5–7.5(–9.5) by 1.4–2 cm, splitting along both sutures. *Seeds* blackish,  $\pm$  glossy, irregularly elliptic, obovate or oblong, 3.5 by 2–3 mm, 1 mm thick, areole 2–3 by 1 mm, pleurogram parallel to the margins, open towards the hilum. — **Fig. 33.**

Field notes — Tree with open branching habit and feathery crown. Bark whitish grey to pale purplish brown, with shallow longitudinal fissures, also horizontally fissured; sapwood straw-coloured, heartwood grey-brown to straw-brown coloured, soft. Leaves once reported to be sensitive to the touch.

Distribution — Solomon Islands, northern part

of Vanuatu, and in *Malesia*: Moluccas (Morotai), New Guinea, Bismarck Archipelago (Manus Is., New Britain).

Habitat & Ecology — Secondary forest and re-growth, forest bordering the beach, coastal plains, savanna, gallery forest, landslides; altitude 0–250 m. Fl., fr. Feb.–Oct.

Uses — Reported to be planted and used for outriggers of canoes.

Note — Closely related to *S. insularum* (Guill.) Burk. from Vanuatu, the only significant difference being the position of the petiolar gland [see Nielsen, Fl. Nouv.-Caléd. et Dépend. 12 (1983) 16].

**b. var. pubescens** Verdc., Kew Bull. 32 (1977) 233; Manual New Guin. Legum. (1979) 159.

Leaflets pubescent all over.

Distribution — Solomon Islands, Bougainville, and in *Malesia*: Bismarck Archipelago (New Ireland).

Habitat & Ecology — As the main variety, but the altitude 0–1800 m.

Uses — There are a few reports of this subspecies as a shade tree for coffee.

## TRIBUS PARKIEAE

*Mimosoideae* tribus *Parkieae* Benth., J. Bot. 4 (1842) 327; Benth. & Hook. f., Gen. Pl. 1, 2 (1865) 588; Taub. in E. & P., Nat. Pflanzenfam. 3, 3 (1891) 123; Hutch., Gen. Fl. Pl. 1 (1964) 279; Elias in Polhill & Raven (eds.), Adv. Leg. Syst. 1 (1981) 153.

Calyx imbricate in bud, sepals joined. Stamens 5 or 10, free or connate at the base; anthers gland-tipped or not.

Distribution — Pantropical.

## PARKIA

(by H.C. Fortune Hopkins)

*Parkia* R. Br. in Denham & Clapp., Narr. Travels Africa, Bot. App. (1826) 289; Benth., J. Bot. 4 (1842) 328; Benth. & Hook. f., Gen. Pl. 1 (1865) 588; Benth., Trans. Linn. Soc. 30 (1875) 360; Taub. in E. & P., Nat. Pflanzenfam. 3, 3 (1891) 123; Hutch., Gen. Fl. Pl. 1 (1964) 280; Elias in Polhill & Raven (eds.), Adv. Leg. Syst. 1 (1981) 153; Hopkins, Fl. Neotrop. 43 (1986) 1–124.

Unarmed trees to 50 m high. *Leaves* bipinnate, alternate or opposite, petiole and rachis usually with extrafloral nectaries, often shortly pubescent; leaflets sessile, opposite. Twigs, inflorescence axes and peduncles often bearing prominent lenticels. *Inflorescence* com-

pound, consisting of a stout twig to 0.5 m long, sparsely branched or unbranched, bearing 2–10 or more flexible peduncles, each to 50 or more cm long and 0.5 cm in diameter, pendent, ending in a swollen, elliptical or clavate axis bearing numerous flowers. *Capitula* pyriform to clavate and velutinous in bud; either clavate or biglobose at anthesis, to 7 cm long, pendent. *Flowers* (in the Malesian species) of 3 kinds; the fertile ones at apex of capitulum; the modified, structurally male and nectar-secreting ones in a constricted ring below; and neuter ones, sometimes bearing elongated staminodia which form a fringe, at base. Fertile flowers pentamerous, functionally bisexual or male, and then the gynoeceum reduced or absent. Bracts obdeltate-spathulate, slightly longer than calyx. Calyx long-tubular or infundibuliform, gamosepalous, the 5 lobes imbricate, 2 larger and 3 smaller. Corolla longer than calyx, the 5 lobes narrowly spatulate or lingulate, free at apex and either connate in the middle and free towards base, or free in the middle and connate towards base. *Stamens* 10, all fertile, shortly exserted; filaments connate below into a tube, to which the corolla may also be adnate. Ovary shortly stipitate; style exserted as far as anthers or beyond; stigma terminal, poriform. *Infructescence* pendent; receptacle swollen, claviform, bearing one to several pods and numerous rhomboidal scars where flowers have fallen. *Pods* stipitate, coriaceous or ligneous, indehiscent or rarely dehiscent, sometimes velutinous, linear, strap-shaped or oblong in outline, sometimes corrugated over the seeds, sometimes twisted. *Seeds* up to 38 per pod, in one row, ellipsoid; testa either hard or soft and thick, bearing a pleurogram. — **Figs. 35, 37.**

**Distribution** — Pantropical with c. 35 species in 3 sections. Most numerous and diverse in tropical America. Only section *Parkia*, to which all the Malesian species belong, is pantropical. — **Figs. 34, 36.**

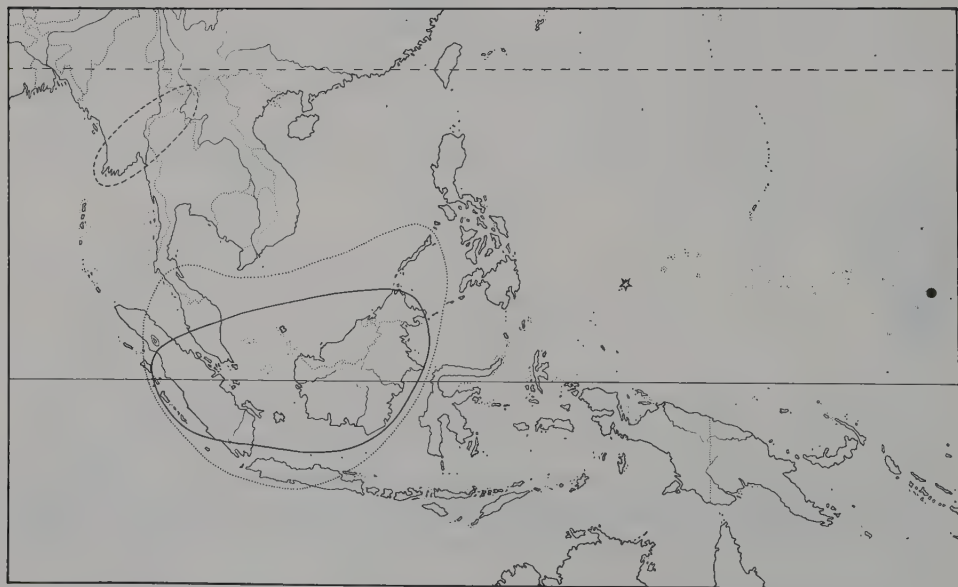


Fig. 34. Distribution of *Parkia korom* Kaneh. (Caroline: Ponape: ●); *P. leiophylla* Kurz (----); *P. parvifoliola* Hosok. (Palau: ☆); *P. singularis* Miq. (both subspecies) (——); *P. speciosa* Hassk. (.....).

**Habitat & Ecology** — Trees of lowland rain forest in Malesia. *Parkia timoriana* and *P. speciosa* both show a synchronised annual cycle of flowering, fruiting and leaf-fall [Holtum, Gard. Bull. Sing. 5 (1931) 200, *ibid* 11 (1940) 153; Medway, Biol. J. Linn. Soc. 4 (1972) 117], and are without leaves for 2 to 3 weeks per year.

**Pollination.** *Parkia speciosa* and *P. timoriana* are pollinated by fruit-bats (*Megachiroptera: Pteropodidae*) [Docters van Leeuwen, Ann. Jard. Bot. Buitenzorg 48 (1939) 41; Van der Pijl, Flora 131 (1936/37) 11; Phillipps, Sabah Soc. J. 6 (2) (1975/76)]. The remaining Malesian species are also expected to be chiropterophilous, though a variety of animals including insects, birds and perhaps nonflying mammals may visit the flowers. The capitula produce a foetid odour and a copious nocturnal supply of nectar. In all the Malesian species the capitulum is yellowish; the fertile flowers usually have cream-coloured filaments and yellow anthers when fresh, and turn dirty yellow the next day. The nectar-secreting region is often brownish yellow. Where there is a basal staminodial fringe, it is pale cream.

**Dispersal.** Birds and mammals have been reported feeding on the fruits: hornbills on *P. speciosa* [Ridley, Disp. (1930) 486], elephants and deer on *P. sumatrana* (Corner, Wayside Trees ed. 3, 1 (1988) 459]; various species of monkeys (Medway & Wells, Malay Nat. J. 24 (1971) 238; Chivers, Contrib. Primatol. 4 (1974)], and squirrels [Medway, Bot. J. Linn. Soc. 4 (1972) 117] on *Parkia* species. There have been no studies of dispersal, however.

**Germination.** Seeds of *P. timoriana* (as *P. javanica*) have a hard testa and will germinate over a period of weeks following planting, whereas those of *P. speciosa*, which have a soft testa, germinate within two weeks of planting or not at all [Ng, Malays. For. 37 (1974) 276; 38 (1975) 171]. Seeds of *P. timoriana* can be stored at room temperature for long periods and scarification by filing, acid treatment or soaking promotes germination [Sasaki, Malays. For. 43 (1980) 161].

**Morphology and anatomy** — The generic description applies to the Malesian species only. In the species descriptions, the range given in values for the number of pairs of leaflets per leaf is that for the longest pinna per leaf, and the leaflet dimensions are those of the largest leaflet per leaf.

The structure of the flower-head, or capitulum, and of the different types of flowers of which each is composed are described by Wee & Rao [Malays. For. 43 (1980) 493]. In Africa and tropical America, the degree of development of the staminodial fringe is usually species specific but this is probably not true in all the Malesian species. The term 'receptacle' has been used to refer to the swollen terminal part of the peduncle to which the flowers are attached.

The term 'pseudopedicel' refers to the constricted region of solid tissue at the base of each flower from which the floral parts arise. The measurements given in the species descriptions for total length of the calyx, corolla and filaments include the pseudopedicel, i.e., are the lengths in undissected flowers.

The pods are occasionally described as containing pulp, as those of some African species do, but it has been impossible to verify this from preserved material.

**Seeds.** For the anatomy of the seed coat of *P. timoriana* (as *P. javanica*), see Corner, Phytomorphology 1 (1951) 117–150.



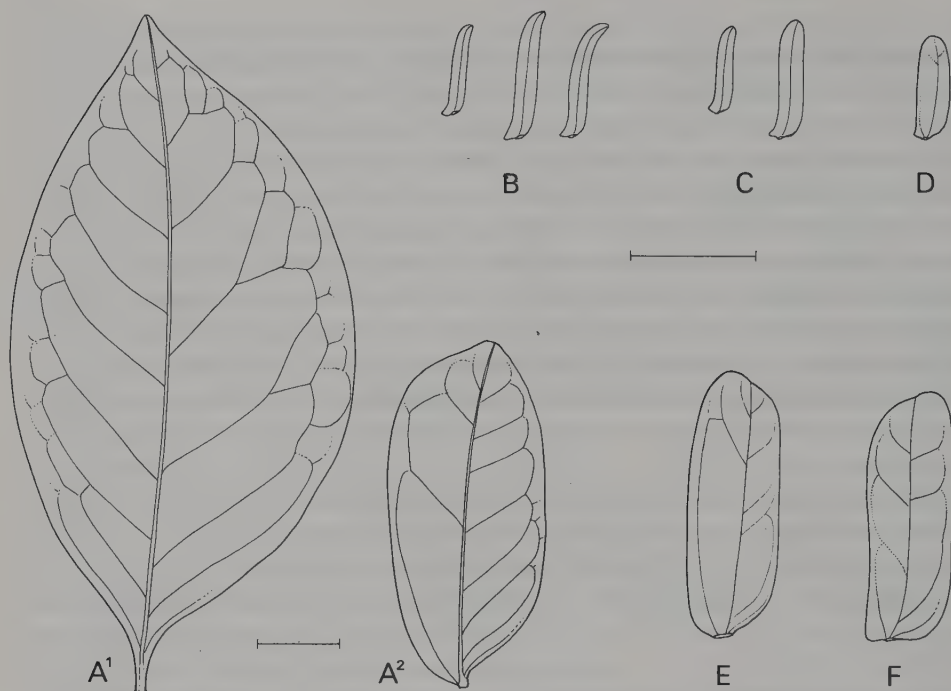


Fig. 35. Leaflets of *Parkia* species in Malaysia. — A<sup>1</sup>. *P. singularis* Miq. subsp. *singularis*. — A<sup>2</sup>. *P. singularis* subsp. *borneensis* H.C.F. Hopkins. — B. *P. timoriana* (DC.) Merr. — C. *P. speciosa* Hassk. — D. *P. versteeghii* Merr. & Perry. — E. *P. sherfesei* Merr. — F. *P. sumatrana* Miq. subsp. *sumatrana*. — Scale bars: 1 cm.

**Pollen.** The ultrastructure of the polyads of *P. speciosa*, *P. timoriana* and *P. versteeghii* is described and illustrated in TEM section and SEM by Feuer, Niezgod & Neuling [Amer. J. Bot. 72 (1985) 1871], together with that of several American and African species.

**Seedlings** of *P. timoriana* (as *P. roxburghii*) and *P. speciosa* are described and illustrated by Burger [Seedlings of some tropical trees & shrubs (1972) 192] and De Vogel [Seedlings of dicotyledons (1980) 323], respectively.

**Phytochemistry** — The seeds of *P. timoriana* (as *P. roxburghii*) and *P. speciosa* contain the nonprotein sulphurous amino acids djenkolic acid, N-acetyl djenkolic acid, and glutamyl cystine [Morris, Bell & Charlwood, Bull. IGSM 6 (1978) 26]. Cyclic polysulphides occur in the beans of *P. speciosa* and contribute to their foul smell [Gmelin, Susilo & Fenwick, Phytochem. 20 (1981) 2521]. Lectins with haemagglutinating activity have been isolated from the seeds of *P. speciosa* and *P. timoriana* (Yadav & Ganaswaran, Malay. J. Sci. 4A (1976) 25; Lee, Plant Medica 31 (1977)]. See further the general phytochemical treatment on p. 15–27.

**Uses** — The wood of *Parkia* species is generally not durable and not highly valued [Burkill, Dict. ed. 2 (1966) 1697]. For uses as food and medicine, see under the species.

## KEY TO THE SPECIES

- 1a. Leaves and peduncles opposite (Fig. 35A) ..... 1. *P. singularis*
- b. Leaves and peduncles alternate ..... 2
- 2a. Largest leaflet per leaf (11.5–)16–21 by (4.5–)6–8 mm (Fig. 35F) ..... 3. *P. sumatrana*
- b. Largest leaflet per leaf (3.5–)5–10.5(–12) by 1–3 mm. .... 3
- 3a. Leaflets linear, falcate or slightly sigmoid, acute at apex (Fig. 35B) ..... 4. *P. timoriana*
- b. Leaflets  $\pm$  straight or oblong; apex rounded ..... 4
- 4a. Leaflets narrowly oblong, 1.5–2(–3) mm broad. W Malesia (Fig. 35C) ..... 2. *P. speciosa*
- b. Leaflets oblong to almost elliptical, (1.5–)2.5–3 mm broad. New Guinea and Solomons (Fig. 35D) ..... 5. *P. versteeghii*

1. *Parkia singularis* Miq., Fl. Ind. Bat. 1 (1858) 1078; Sumatra (1860) 105, *ibid.* (1861) 285; Merr., J. Str. Br. Roy. As. Soc. no 76 (1917) 84; *ibid.* Special no. 86 (1921) 295; Whitm., Tree Fl. Malaya 1 (1972) 281; Cockb., Trees Sabah 1 (1976) 193, f. 42; Hopkins, Blumea 37 (1992) 78.

## KEY TO THE SUBSPECIES

- 1a. Leaflets 3 (or 4) pairs per pinna,  $\pm$  ovate, up to 8.5(–12) cm long, apex acute, base  $\pm$  symmetrical, attenuate; pinnae 1 or 2 pairs  
a. subsp. *singularis*
- b. Leaflets (2–)4–5(–7) pairs per pinna,  $\pm$  elliptical to oblong, up to 5.5(–6.5) cm long, apex rounded or emarginate, base often asymmetrical, rounded or obtuse; pinnae 2(–4) pairs  
b. subsp. *borneensis*

a. subsp. *singularis*

Tree to 30 or more m high. *Leaves* opposite and decussate, primary rachis including petiole 2–9 (–11.5) cm long. Glands on primary rachis circular, base of secondary rachises, and on secondary rachises at base of leaflets. Pinnae 1 or 2 pairs, opposite, rachis 5–12.5 cm long. Leaflets 3 (or 4) pairs, elliptical to subrhomboidal, somewhat asymmetrical, to (4.5–)6.4–12 by (2.5–)3.5–7.5 cm, increasing in size distally along each rachis; apex acute or rarely rounded, base attenuate; main nerve placed slightly towards distal margin, straight at apex. *Peduncles* 1–4 pairs, opposite, 7.5–50 cm long. *Capitula* 3.9–6.3 cm long, calvate at anthe-

sis with basal staminodial region poorly developed or rarely biglobose with staminodial region well developed. *Flowers* bisexual. Calyx 7.5–9 mm long, including pseudopedicel of 1–2 mm and the largest lobes 1–1.5 mm long; corolla 8–9 mm long, the lobes fringed with short hairs and c. 1 mm long, then fused below for 1–1.5 mm, then free below almost to pseudopedicel; filaments exerted 1–3 mm beyond calyx, united to 5–7 mm from base, anthers c. 1 mm long; ovary 3–5 mm long, on a short stipe; style 2–4 mm long. *Pods* often 10 or more per head, strap-shaped, often twisted, the valves coriaceous, sometimes  $\pm$  swollen over seeds, glabrous with veins prominent, 15–35 by 1.7–2.8 cm, gradually attenuate at base into a narrow stipe (2.5–)4–15 cm long. *Seeds* c. 15 per pod, either circular in outline or elliptical and then lying diagonally across the width of the pod; testa blackish. – Fig. 35 A<sup>1</sup>.

Distribution – Malay Peninsula, Sumatra, and occasionally in Borneo. – Fig. 34.

Habitat & Ecology – Primary lowland rain forest; 20–500(–700) m altitude, including dipterocarp forest, and *Agathis* forest on acid, sandy, waterlogged soil, and on loamy soil.

Field notes (for both subspecies) – Tree first reproducing at c. 10 m high. Buttresses low and narrow, to 1.2 m high, or absent. Bark smooth to rough, fissured or flakey, often described as having a superficial pattern of broad to fine cracks between flat ridges or scales; white, yellowish-grey, grey, reddish brown to greenish or pale brown. Slash: inner bark usually reddish (pink-brown, red-brown or darkish red) or sometimes pale, yellowish or grey, fibrous or hard, homogeneous; no smell; sap-

wood white, yellowish, yellow-brown or ochre; heartwood dark brown. Buds usually chocolate brown or rarely green.

Uses – Fruits and seeds occasionally described as edible.

**b. subsp. borneensis** H.C.F. Hopkins, *Blumea* 37 (1992) 79.

Primary rachis including petiole (1.5–)3–10 (–13.5) cm. Pinnae 2(–4) pairs, secondary rachises 3.5–9.5 cm long. Leaflets (2–)4–5(–7 or –9?) pairs per pinna, (2.2–)4.3–6.1 by (0.8–)2.4–3.4 cm,  $\pm$  elliptical to oblong, apex rounded or emarginate, base often asymmetrical, rounded or obtuse, not strongly auriculate. – **Fig. 35 A<sup>2</sup>**.

Distribution – Borneo (Kalimantan, Sarawak, Sabah). – **Fig. 34**.

Habitat & Ecology – Lowland primary rain forest including dipterocarp forest and freshwater swamp forest; on podsols, sandy clay and loam.

Notes – The foliage of this species is very distinct from that of the other species since it has opposite and decussate leaves with few, large leaflets.

Morphological and geographical separation of the subspecies is not absolute, and a minority of gatherings are difficult to assign.

In addition, there are a number of specimens with leaf characters intermediate between *P. singularis* and *P. sumatrana*. They may be anomalous for a variety of reasons, and it is unlikely that all are unplaced for the same reason. Some may be aberrant forms of either *P. singularis* subsp. *borneensis* or *P. sumatrana*, some may be of hybrid origin, or some might represent a novel taxon. More complete material is needed with detailed ecological notes, and showing the shape of the capitulum at anthesis and the size and shape of the mature pods (also see notes to *P. sumatrana*).

**2. *Parkia speciosa*** Hassk., *Flora* 25 (1842) 55, 105; Miq., *Fl. Ind. Bat.* 1 (1855) 53; Heyne, *Nutt. Pl. Ned. Ind. ed.* 2 (1927) 725; Corner, *Wayside Trees* 1 (1940) 415, t. 105 & 106, f. 137; Backer & Bakh. f., *Fl. Java* (1963) 564; Burkill, *Dict. ed.* 2 (1966) 1700; Whitm., *Tree Fl. Malaya* 1 (1972) 281, t. 13; Cockb., *Trees Sabah* 1 (1976) 193, f. 42; Santisuk, *Vanasarn* 38 (1980) 175, f. 2; Nielsen & Santisuk, *Fl. Thailand* 4 (1985) 136, f. 32: 8, t. viii: 1 & 2.

*Inga pyriformis* Jungh., *Reisen Java* (1845) 419.

*Parkia macrocarpa* Miq., *Fl. Ind. Bat., Suppl.* 1, *Sumatra* (1861) 284; Benth., *Trans. Linn. Soc.* 30 (1875) 361, p.p., excl. fruit.

*Mimosa pedunculata* Hunter, *J. Str. Br. Roy. As. Soc.* no 53 (1909) 121, nom. illeg., non Poiret (1810), nec Roxb. (1832).

*Parkia harbesonii* Elmer, *Leaf. Philipp. Bot.* 3 (1913) 1804; Merr., *Enum. Philipp. Fl. Pl.* 2 (1923) 253.

*Parkia biglobosa* auct. non (Jacq.) R. Br. in Loud.: Miq. et al., *Pl. Jungh.* (1845) 266; Koord. & Val., *Bijdr.* 1 (1894) 276.

Tree to 35(–45) m high. *Leaves* alternate, primary rachis including petiole (11–)21–34(–45) cm long. Gland on petiole single, elliptical, midway between base and 1st pair of pinnae, c. 1–3 cm from base; smaller circular glands on primary rachis between ultimate pair(s) of pinnae. Pinnae 11–20(–25) pairs, opposite or subopposite, rachis (3.5–)6–9(–10) cm long; leaflets (18–)29–42 pairs,  $\pm$  oblong, (3–)5–10(–12) by (1–)1.5–2(–3) mm, margins of adjacent ones contiguous or overlapping, glabrous or with a few hairs around the margin; apex rounded, base strongly auriculate on proximal side; main nerve central, straight at apex or slightly sigmoid. *Peduncles* 4–10 per compound inflorescence reaching maturity, alternate, 7–57 cm long. *Capitula* 5.4–6.7 cm long, somewhat biglobose at anthesis with central constricted nectar-secreting region c. 2.5 cm in diameter, the basal staminodial region somewhat broader, and the apical fertile part elliptical to ovate, 3.2–4.2 cm in diameter, or less in dried material. *Flowers* bisexual. Calyx 6.5–9.5 mm long, including pseudopedicel of 1.5–2 mm, and the largest lobes 1–1.5 mm long; corolla 7.5–10 mm long, the lobes pubescent on outer surface, 1–1.5 mm long, then fused below for 1–3 mm, and free below; filaments exerted 2–4.5 mm beyond calyx, and united to 5–8.5 mm from base. *Pods* strap-shaped, usually twisted, the valves coriaceous, conspicuously swollen over, and indented between the seeds, glabrous, the veins prominent and forming a reticulate network, c. 20–40 by 2–4.9 cm, gradually attenuate at base into a narrow stipe 3–13.5 cm long. *Seeds* c. 18 per pod, elliptical or broadly elliptical in outline, lying horizontal or obliquely horizontal across the width of the pod, up to 23 mm long, foul smelling; testa green, softish. – **Fig. 35 C**.

Distribution – S Thailand and *Malesia*: Sumatra, Malay Peninsula, Borneo, Philippines (Palawan only). Cultivated outside its natural range in Indonesia as far east as Seram (E. Wijadja, personal comm.). In Java, frequently cultivated. – **Fig. 34**.



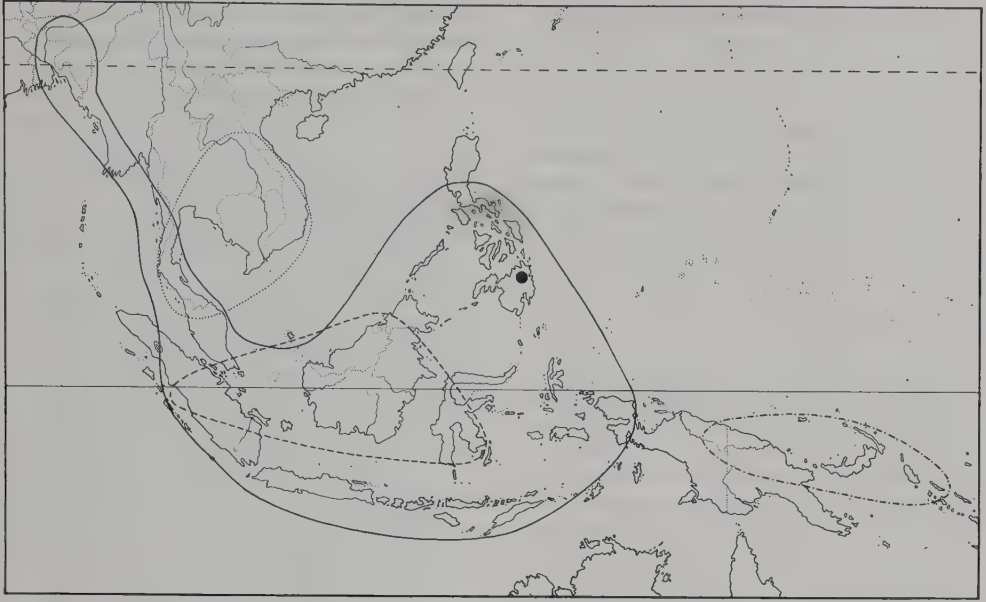


Fig. 36. Distribution of *Parkia sumatrana* Miq. subsp. *sumatrana* (-----); *P. sumatrana* subsp. *streptocarpa* (Hance) H.C.F. Hopkins (.....); *P. timoriana* (DC.) Merr. (———); *P. versteeghii* Merr. & Perry (- · - · - · - · -); *P. sherrfesei* Merr. (●).

**Habitat & Ecology** – Lowland rain forest, on a range of soil types and topography, including river banks; often common but scattered; altitude 0–900 (–1420) m. Also cultivated near habitation.

**Field notes** – Trunk up to 1 m d.b.h.; tree first flowering at about 15 m high. Buttresses to 1.5 m high or absent. Bark usually smooth, light brown or grey, less often rich brown-blackish or reddish grey, sometimes with white or brown patches or scaly, flaking into small irregular pieces. Slash: inner bark usually pale pink to deep red or red-brown, with red rays and white between, less often grey or yellow brown; slash wood white, pale yellow or yellowish-orange or -brown. Buds usually green.

**Uses** – The mature green seeds are eaten avidly but in small quantities in Peninsular Malaya and Indonesia as a flavouring in stews. They are sold fresh as bunches of pods in markets, and as pods or loose seeds, either fresh or tinned, in supermarkets. They have a strong, distinctive and disagreeable odour and flavour, reminiscent of bad onions or garlic, and are said to make those who consume them smell also (Burkill l.c.; Heyne l.c.); they are said to have a diuretic and relaxing effect. Young pods are also sometimes cooked as a vege-

table, and young seeds may be eaten pickled, raw or cooked. Young leaves and the fleshy part of the receptacle are also reported as edible. The pods are reported as containing some edible pulp (e.g. Hunter l.c.; Burkill l.c.), but if so, the quantity is very much less than in the African *P. biglobosa*. The seeds are used medicinally against liver disease, diabetes, and worms.

**Notes** – 1. The earliest reference to this species was Rumphius [Herb. Amb. 3 (1743) 51], who mentioned the pungent tasting fruits of the pete tree.

2. The shape of the capitulum at anthesis varies due to the degree of development of the staminal fringe, of which the diameter ranges from scarcely more than that of the nectar-secreting region to almost twice its diameter. The pods are rather variable in size, shape, number per infructescence, and degree of twisting [see illustration in Sastrapradja & Djajasukma, Berita Biologi 2 (1979) 87].

3. Similarity to and confusion with *P. timoriana* are dealt with under that species.

**3. *Parkia sumatrana* Miq., Fl. Ind. Bat., Suppl. 1, Sumatra (1861) 284; Hopkins, Blumea 37 (1992) 77.**

## KEY TO THE SUBSPECIES

- 1a. Pods 4.2–5.4 cm wide, valves velutinous, especially near sutures, shallowly corrugated over seeds; leaflets 12–20 pairs per pinna

a. subsp. *sumatrana*

- b. Pods c. 2 cm wide, valves glabrous, markedly swollen over seeds and constricted between them; leaflets 14–37 pairs per pinna

b. subsp. *streptocarpa*a. subsp. *sumatrana*

*Parkia macrocarpa* Miq., Fl. Ind. Bat., Suppl. 1 (1861) 284; Benth., Trans. Linn. Soc. 30 (1875) 361, p.p., excl. leaves.

Tree to 35 m tall. *Leaves* alternate or rarely opposite, primary rachis including petiole to 36 cm long. Gland on petiole single or rarely double, elliptical, c. 2 cm from base; smaller raised circular glands on primary rachis between ultimate pairs of pinnae. Pinnae (5–)7–11 pairs, opposite or alternate, rachis to 9.5 cm long, bearing red-brown pubescence. *Leaflets* 12–20 pairs per pinna, oblong (11.5–)16–21 by (4.5–)6–8 mm, with a small gap between adjacent leaflets and sparse white hairs at base along margins and on midvein; apex rounded or slightly retuse, mucronulate, base weakly auriculate; main vein slightly excentric, somewhat diagonal or slightly sigmoid. (Floral characters based on *Waturandang* 206). *Peduncles* c. 14–44 cm long; receptacle 3.5–4.8 cm long; shape of capitulum unknown. *Flowers* bisexual; bracts c. 10 mm long, markedly truncate at apex; calyx to 10 mm long, including pseudopedicel of 2 mm, and the largest lobes 1.5–2 mm long; corolla to 11.5 mm long, the lobes 1.5–2 mm long, then united below for 2 mm, and free towards base; filaments to 14 mm long, united to 9 mm from base; gynoeceum with stipe of 2.5 mm, ovary c. 3 mm, bearing red-brown hairs, and style of 3 mm, not protruding beyond filaments. *Pods* up to c. 8 per head, strap-shaped, c. 45 cm long (including stipe of 4–10 cm) by 4.2–5.4 cm broad, the valves shallowly corrugated over the seeds, densely covered in yellow-brown velutinous pubescence especially near sutures, glabrescent when old. *Seeds* 26–33 per pod, elliptical in outline, lying horizontally across width of pod; testa hard, dark brown. – **Fig. 35 F.**

*Distribution* – *Malesia*: Sumatra, Borneo, perhaps Philippines (see *P. sherrfesei*, under insufficiently known species), Celebes. – **Fig. 36.**

*Habitat & Ecology* – Forest at low altitude, including forests overhanging rivers. Widely distributed but apparently uncommon.

*Uses* – Fruits reported as edible.

- b. subsp. *streptocarpa* (Hance) H.C.F. Hopkins, Blumea 37 (1992) 78.

*Parkia streptocarpa* Hance, J. Bot. Lond. 14 (1876) 258; Hô, Illus. Fl. S. Viêt-nam, ed. 2, 1 (1970) 810, f. 2047.

*Parkia dongnaiensis* Pierre, Fl. For. Cochinch. 5 (1899) t. 393A; Gagnep., Fl. Gén. Indochine 2 (1913) 109; Hô, Illus. Fl. S. Viêt-nam, ed. 2, 1 (1970) 809, f. 2046.

*Parkia sumatrana* auct. non Miq., p.p.; Whitm., Tree Fl. Malaya 1 (1972) 282; Nielsen, Adansoniana sér. 2, 19 (3) (1980) 339; Santisuk, Vannasarn 38 (1980) f. 3; Nielsen, Fl. Camb. Laos Vietnam 19 (1981) 11, pl. 1; Nielsen & Santisuk, Fl. Thailand 4 (1985) 137; Corner, Wayside Trees ed. 3, 1 (1988) 459.

Pinnae 6–12(–18) pairs per leaf. *Leaflets* 14–37 pairs per pinna, 10.5–25 by 3–8 mm. *Capitula* clavate at anthesis, 4–5 cm long, 3 cm in diameter (fide Gagnepain). *Flowers* bisexual. Calyx to 11 mm long, including pseudopedicel and lobes; corolla to 12 mm long, the lobes c. 8 mm long (fide Nielsen & Santisuk l.c.). *Pods* narrowly strap-shaped, c. 14.5–52 cm long (including stipe up to 10 cm long) by 1.9–2.1 cm wide, the valves glabrous, straight or sometimes twisted, and markedly swollen over the seeds. *Seeds* 10–13 per pod, lying diagonally across width of the pod.

*Distribution* – Burma, Thailand, Indochina; in *Malesia*: Malay Peninsula, and perhaps Borneo. – **Fig. 36.**

*Habitat & Ecology* – Scattered in dry evergreen forest, often along streams, in hilly areas, on sandy, stony or clayey soils, altitude 100–600(–900) m.

*Field notes* – Tree first flowering at 12–15 m. Trunk to 1 m d.b.h. Bark grey and smooth when young, brown and scaly when mature. Slash: yellow; wood yellow turning pale brown; exudes a red resin; wood foetid with unequal coarse fibres.

*Uses* – Young leaves and young seeds are edible (Nielsen 1981; Nielsen & Santisuk 1985). The powdered bark is reported as having medicinal uses, including against leeches in Indochina (*Vidal* 5063).

*Notes* – 1. Although the majority of *Parkia* specimens from Malesia with medium-sized oblong leaflets are readily referable to either *P. singularis* subsp. *borneensis* or to *P. sumatrana*, a minority are not.

Using all available material, there is a continuum of variation in leaf characters (number of pairs of pinnae and leaflets, size and shape of leaflets) between the two taxa. The majority of 'intermediate' or unplaced collections are from Borneo. *Kosterians* 10237 with narrow, glabrous, twisted pods and *Hallier* 2420 with rather numerous leaflets, raise the possibility that *P. sumatrana* subsp. *streptocarpa* occurs in Borneo. The capitula of *Haviland* 2907 differ from both *P. sumatrana* and *P. singularis* by having a well developed staminodial fringe and a spherical ball of fertile flowers.

An interesting situation exists where *P. singularis* and *P. sumatrana* can be readily distinguished from each other where they are sympatric in the western part of Malesia, but there appears to be a gradation in vegetative characters between them in Borneo.

2. Little flowering material is available for *P. sumatrana* and it is not possible to say whether the difference in the corolla lobes between subsp. *sumatrana* and subsp. *streptocarpa* is constant.

**4. *Parkia timoriana* (DC.) Merr., Philipp. J. Sc., Bot 5 (1910) 33; J. Str. Br. Roy. As. Soc., Special no. 86 (1921) 295; Nielsen, Adansonia sér. 2, 19 (3) (1980) 340; Nielsen & Santisuk, Fl. Thailand 4 (1985) 138.**

*Inga timoriana* DC., Prod. 2 (1825) 442.

*Parkia roxburghii* G. Don, Gen. Syst. 2 (1832) 397; Backer & Bakh. f., Fl. Java 1 (1963) 564; Perry, Medic. Pl. E & SE Asia (1980) 221; Hirschhorn, J. Ethnopharm. 8 (1983) 86.

*Mimosa peregrina* Blanco, Fl. Filip. ed. 1 (1837) 737; ed. 2 (1845) 509; ed. 3, 3 (1897) 139; non L. [fide Benth., J. Bot. 4 (1842) 329].

*Parkia grandis* Hassk., Flora 25, 2 (1842) 55, 106. *Acacia niopo* Llanos, Mem. Acad. Cienc. Madrid 4 (1858) 508, fide Merr. (1910).

*Parkia calcarata* Gagnep. ex Lecomte, Not. Syst. 2 (1911) 56.

*Parkia biglobosa* auct. non (Jacq.) R. Br. in Loud.: Benth., J. Bot. 4 (1842) 328, p.p. quoad spec. trop. Asia; Hassk., Pl. Jav. Rar. (1848) 415; Miq., Fl. Ind. Bat., Suppl. 1, Sumatra (1861) 283; Koord. & Val., Bijdr. 1 (1894) 276; Heyne, Nutt. Pl. Ned. Ind. ed. 2 (1927) 724.

*Parkia africana* auct. non R. Br.: Miq., Fl. Ind. Bat. 1 (1855) 52; Hassk., Cat. Pl. Hort. Bog. Cult. (1844) 289.

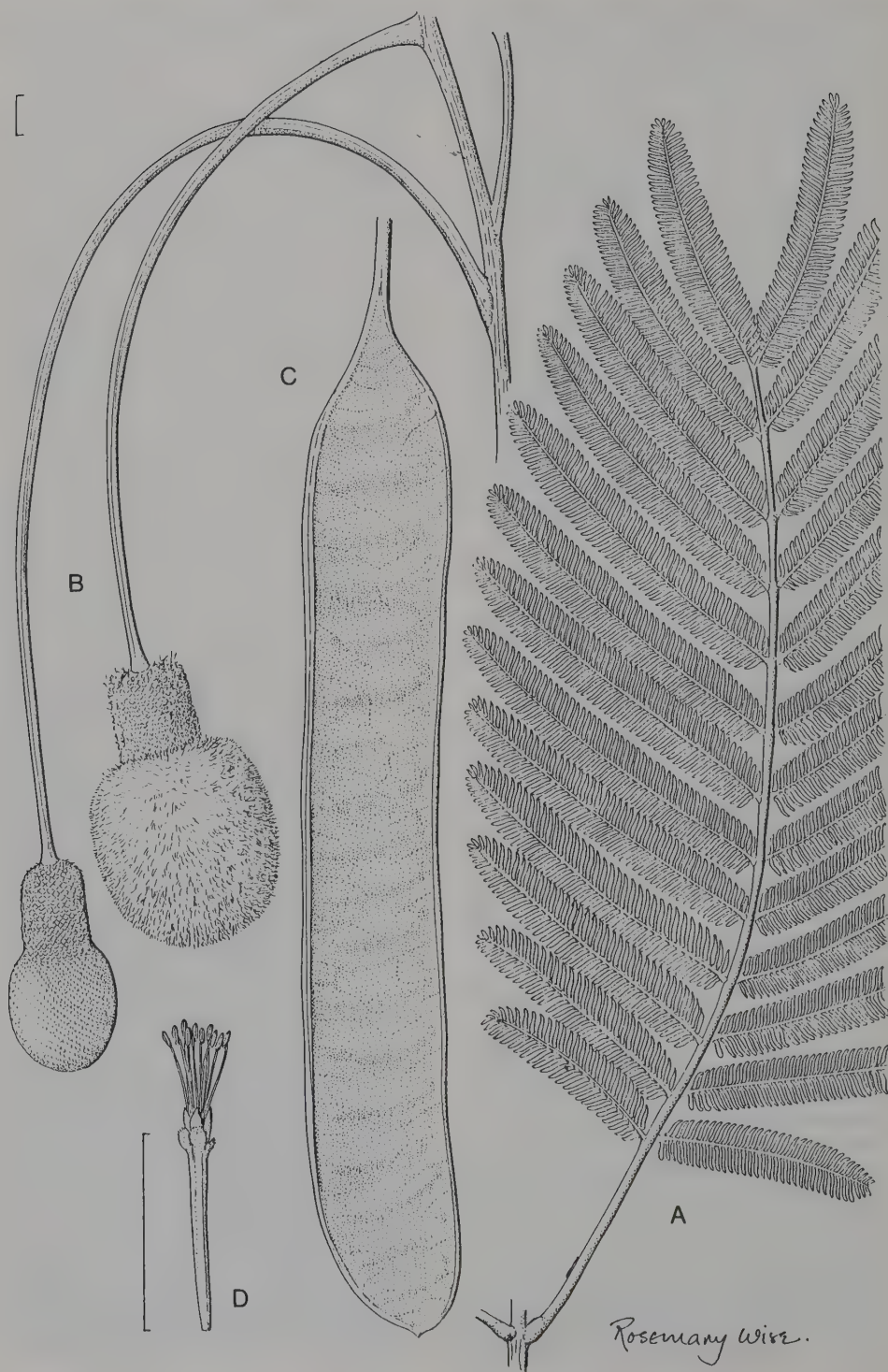
*Parkia javanica* auct. vix (Lam.) Merr.: Merr., Sp. Blanc. (1918) 168; Enum. Philipp. Fl. Pl. 2 (1923) 253; Corner, Wayside Trees 1 (1940) 415; ibid. ed. 3 (1988) 458; Burkill, Dict. ed. 2 (1966)

1698; Whitm., Tree Fl. Malaya 1 (1972) 281, f. 13; Cockb., Trees Sabah 1 (1976) 191, f. 42.  
— See also notes.

Tree to 50 m high, 2.5 m in diameter. *Leaves* alternate, primary rachis including petiole 18–42 cm long. Gland on petiole 1 or sometimes 2, 1.5–4 cm from base, in fresh material raised c. 1 mm, 0.5 cm long; smaller glands on primary rachis between ultimate pairs of pinnae. Pinnae 14–31 pairs, opposite or subopposite especially in middle of leaf, the lower pinnae often caducous, rachis 8.7–11.5 cm long. *Leaflets* 52–72 pairs, somewhat sigmoid, 6–10.5 by 1–2 mm, margins of adjacent leaflets contiguous, with stiff white hairs around margin, scattered on upper surface and sparse on lower surface; apex acute, base auriculate on proximal side, main nerve central, sigmoid, and curved towards distal margin at apex. Sapling leaves larger, to 62 cm or more long, the leaflets up to 82 pairs per pinna, 14.5–18 by 2.5–3.5 mm. *Peduncles* usually c. 4–7 per compound inflorescence reaching maturity, alternate, 8.5–33 cm long. Capitula 5.5–6.7 cm long, somewhat biglobose at anthesis, with central constricted nectar-secreting region 2.1–2.5 cm in diameter, short basal staminodial region somewhat broader, to 3 cm in diameter, and apical fertile part elliptical, 3.1–4.5 cm in diameter, or less in dried material. *Flowers* bisexual. Calyx 9–10.5 mm long including pseudopedicel of 1–2 mm, and the largest lobes 1–1.5 mm long; corolla 10–11 mm long, the apical lobes 1–1.5(–2) mm long, rough on outer surface, then united below for c. 2 mm, then free towards base; filaments exerted 2–3.5 mm beyond calyx, the staminal tube 5–7.5 mm long. *Pods* strap-shaped, flat or rarely twisted (not in Malesia), the valves woody, rough, scarcely or not corrugated over seeds, glabrous with a reticulate network of fine cracks, and larger cracks developing between the seeds in old pods, the veins prominent across the width of the pod as a coarse network, sutures not thickened, 20–33 by 3.9–5.5 cm, the base abruptly attenuate into a stipe 6–15.5 cm long; inner surface of valves smooth, cream-coloured, lacking pulp, indented round each seed. *Seeds* c. 12–19 per pod, elliptical in outline, lying horizontally across width of pod, c. 1.4–2 cm long; testa hard, dark brown. — **Figs. 35 B, 37.**

Distribution — NE India, Bangladesh, Burma, Thailand; in *Malesia*: Malay Peninsula, Sumatra, Borneo, Java, Philippines (Palawan, Luzon), Celebes, Lesser Sunda Islands (W Sumbawa, Timor), Moluccas, New Guinea (Irian Jaya). — Fig. 36.





**Habitat & Ecology** – Lowland rain forest, mixed deciduous and dry evergreen forests, sometimes common; altitude 0–600(–1300) m. Briefly deciduous.

**Field notes** – Trunk often with plank buttresses at base, 1–4 m high, spreading 1–2 m or more outwards. Bark smooth or sometimes finely cracked, lenticellate, whitish, light brown, grey, or sometimes dark grey-brown. Slash: inner bark from pale pink to beefy red, sometimes streaked with white, paler or yellower inwards for 1–2.5 cm, fibrous; sapwood white or pale yellow or brownish white.

**Uses** – Seeds, bark and sometimes leaves are reported as having medicinal uses (Burkill, Heyne, Hirschhorn, Perry, Il. cc.). The bark is used against scabies, boils, and abscesses, and the pods, pounded with water, are used as a hair shampoo. Ripe seeds, roasted and powdered, can be ingested as a medicine for colic, flatulence and stomach ache, or used in remedies for cholera or menstrual cramps. Powdered seeds are applied externally to wounds, ulcers, and the abdomen for pain. Leaves may also be ground up as an ingredient in a remedy for colic. The seeds may be eaten as a substitute for those of *P. speciosa* after roasting, or when young, but they have a bitter flavour. Germinated seeds are consumed in Thailand (Nielsen & Santisuk, l.c.).

**Notes** – 1. Some early references confused this Asian species with *P. biglobosa* (syn. *P. africana*) from West Africa. It has also occasionally been confused with *P. speciosa*, with which it probably hybridizes (see *P. intermedia*, under uncertain species). Its flowers can often be distinguished from those of *P. speciosa* by the lack of pubescence on the outer side of the corolla lobes in some specimens. In dried material, its leaflets differ from those of *P. speciosa* by not curling inwards in the middle.

2. It is the most widespread Asian species, and the only one that occurs on both sides of Wallace's Line.

3. Nielsen (1980) discusses the validity of the name *Parkia javanica* (Lam.) Merr., by which this species is well known in Malaysia. He concludes that the name is uncertain, a decision with which I concur.

4. While there has been general consensus that material from NE India and Bangladesh is conspecific with that from Malesia, and leaflet shape is

similar, the pods from NE Indian and Bangladeshy specimens may be somewhat corrugated over the seeds.

**5. *Parkia versteeghii* Merr. & Perry, J. Arnold Arbor. 23 (1942) 396; Verdc., Manual New Guin. Legum. (1979) 132, t. 32.**

Tree to 35 m tall. *Leaves* alternate, primary rachis including petiole to 35 cm long; petiole with a single round or elliptical, or bilobed, or double gland, halfway between base and 1st pair of pinnae; rachis bearing dense rusty pubescence. Pinnae (8–) 11–19 pairs, opposite or lower ones subopposite. *Leaflets* 27–38 pairs, oblong, (3.5–)6.5–9 by (1.5–)2.5–3 mm, margins not contiguous, with sparse, short, stiff, white hairs on margin and upper surface; apex rounded and sometimes minutely mucronulate, base usually weakly auriculate on proximal side, main vein central, straight or slightly curved towards distal margin at apex, when dry depressed on upper surface and prominent below and margins recurved. *Peduncles* 2–4 per compound inflorescence reaching maturity, alternate, 5–22(–40) cm long. *Capitula* 4.7–6 cm long, biglobose at anthesis with basal staminodial fringe, 3.6–5.1 cm in diameter and apical part 3.1–4.3 cm in diameter. *Flowers* bisexual. Calyx 9–9.5 mm long, including pseudopedicel of 2 mm, and the largest lobes c. 1.5 mm long; corolla to 11.5 mm long, the lobes c. 6.5 mm long, bearing tiny hairs on outer surface at apex; filaments to 13.5 mm, the staminal tube 5–7 mm long; anthers 1.3 mm long; ovary 1.5–2 mm long. *Pods* usually one per receptacle, strap-shaped, 28–38 cm (incl. a stipe of c. 5–13 cm) by 4–5 cm, the valves bearing red-brown velutinous pubescence, especially along the sutures when immature, glabrescent. *Seeds* to 18 per pod, elliptical or round in outline, 17–21 by 11.5–14 by 5 mm; testa black around outer edge and paler brown with black radiating streaks within the pleurogram, hard. – **Fig. 35 D.**

**Distribution** – Solomon Islands (Choiseul); in **Malesia**: Irian Jaya (Idenburg R.), Papua New Guinea (Gogol Valley). – **Fig. 36.**

**Habitat & Ecology** – Occasional tree of primary and tall secondary lowland forest, especially at edges of flood plains; both well-drained and swampy situations; altitude 8–125 m. Scattered distribution, apparently rare.

Field notes – Trunk up to 1 m d.b.h. Buttresses 2 by 2 m and forked towards the ends, or absent. Bark brown, grey-brown or red-brown, smooth. Slash: inner bark pale straw brown; slash wood hard, creamy brown or straw-coloured; smells. Mature foliage dark green above and much paler below. Buds dark golden brown.

Uses – Timber of low density used for carpentry and construction (Verdcourt, l.c.).

#### UNCERTAIN STATUS

*Parkia intermedia* Hassk., Tijdsch. Nat. Ges. Physiol. 10 (1843) 149; Cat. Pl. Hort. Bog. (1844) 289; Pl. Jav. Rar. (1848) 414; Miq., Fl. Ind. Bat. 1 (1855) 53; Koord. & Val., Bijdr. 1 (1894) 276; Prain, J. As. Soc. Beng. 67, 2 (1897/8) 241, sub *P. speciosa*; Merr., Philipp. J. Sc., Bot. 5 (1910) 35, sub *P. roxburghii*; Backer, Schooffl. Java (1908) 104; *ibid.* (1911) 425; Heyne, Nutt. Pl. Ned. Ind. ed. 2 (1927) 724; Steenis, Fl. Males. I, 4 (2) (1949) lxii; Backer & Bakh. f., Fl. Java 1 (1963) 564; Whitm., Tree Fl. Malaya 1 (1972) 282, sub *P. speciosa*.

Description after Hasskarl and Backer as follows: Tree. Leaves alternate. Petiole with 1 or 2 basal, oblong glands; rachis bearing velutinous pubescence. In adult trees, pinnae (8–)14–24 pairs, leaflets 18–56 pairs per pinna, linear oblong, mucronulate, ciliolate; length/breadth ratio 3–6 and apex  $\pm$  acute ('forma *intermedia*') or l/b ratio up to 4 and apex  $\pm$  obtuse ('forma *pseudo-speciosa*'). In juvenile trees, pinnae up to 42 pairs; leaflets 40–80 pairs per pinna, subfalcate, acute. Pods 20–27 cm long (including stipe) by 4–5 (?) cm, strongly swollen over seeds, not or scarcely twisted ('forma *intermedia*') or twisted ('forma *pseudo-speciosa*'). Seeds oval, 2–2.5 by 1.25–1.5 cm, testa fairly hard; taste bitter.

Uses – Seeds consumed like those of *P. speciosa* (Heyne, l.c.) though harder and with a stronger smell.

Notes – This appears to be a hybrid between *P. speciosa* and *P. timoriana*. It is found almost exclusively in Java where it is probably an ancient cultivar. Originally described by Hasskarl as intermediate between its two probable parents (*P. timoriana* as *P. grandis*), he described the vegetative characters (Hasskarl 1844), saying that the leaflets were linear-oblong and obtuse in mature foliage (i.e. resembling *P. speciosa*) but more numerous, linear-falcate, and acute in juvenile leaves (i.e. similar to *P. timoriana*).

Subsequent authors have raised questions about the status and identity of *P. intermedia*, for example Prain, Backer, and Merrill. The situation has been complicated by confusion over types, the distribution to herbaria of mixed collections, occasional confusion of *P. speciosa* and *P. timoriana*, and possible distinctions between *P. timoriana* and *P. roxburghii*.

Backer (1911) described it as a hybrid between *P. speciosa* and *P. timoriana* (as *P. roxburghii*) which always grew from seed of *P. speciosa* (see also Van Steenis 1949). Backer distinguished two forms, the typical one, 'petir', and form *pseudo-speciosa* ('gundjae', also called 'pindej') which was a backcross, i.e. a hybrid between *P. intermedia* and *P. speciosa*. A table of comparison in the herbarium at Bogor gives differences between petej (*P. speciosa*), pindej, and petir, in the seeds, flower-heads, leaves, bark, habit, and abundance. The most distinctive differences appear to be in the seed, but these are absent from almost all collections labelled *P. intermedia* at BO. In petej, the seeds are "largest, softest, not bitter, best to eat"; in petir "intermediate in size and hardness,  $\pm$  bitter, edible" (translation by H. Wiriadinata).

#### INSUFFICIENTLY KNOWN

*Parkia sherefesei* Merr., Philipp. J. Sc., Bot. 10 (1915) 9; Enum. Philipp. Fl. Pl. 2 (1923) 253.

Tree to 27 m high by 1.2 m d.b.h. The young branchlets, rachises, peduncles and bud capitula covered in ferruginous to yellow-brown pubescence. Leaves to 50 cm long (fide Merrill). Pinnae 8–12 pairs, opposite, rachises to 16 cm long; leaflets c. 22 pairs, with gap of 3 mm between adjacent margins, oblong, 21–25 by 0.9–1 cm; apex rounded, inequilaterally retuse and minutely mucronulate, base rounded, inequilateral, main vein slightly excentric and placed towards distal margin, straight at apex, drying pale; sparse white hairs at base on margin and main vein. Peduncles 25–30 cm long, plus receptacle c. 4.1 cm long. Bud capitula obovoid or pyriform, 4–5 by 2.5 cm. Flowers: bracts and calyx c. 7 mm long. Fruits unknown. – Fig. 35 E.

Distribution – Endemic to Mindanao (Philippines). – Fig. 36.

Habitat & Ecology – Tidal streams and Nipa swamp at sea level.

Note – Described from incomplete material, but some collections cited by Merrill (1923) have not been traced. The leaves resemble *P. sumatrana*, but the habitat suggests a different ecology. Pods are needed to assess whether it is morphologically distinct or not.



## EXCLUDED AND DUBIOUS

*Affonseia pteropoda* Kosterm., *Adansonia* sér. 2, 6 (3) (1966) 371, pl. 5 = *Harpullia rhachiptera* Radlk. (*Sapindaceae*).

See Verdcourt, *Kew Bull.* 32 (1977) 222.

*Gagnebina tamariscina* DC.; *Miq.*, *Fl. Ind. Bat.* 1 (1855) 47.

A Madagascan taxon not found in Malesia.

*Schrankia* Willd.

Ascending or more or less climbing, aculeate herbs or shrubs, hardly separable from *Mimosa* except for the narrow terete-tetragonous pods.

*Schrankia leptocarpa* DC., *Prod.* 2 (1825) 443; Backer & Bakh. f., *Fl. Java* 1 (1963) 561.

An American species that does not seem to have established outside the area mentioned by Backer & Bakhuizen f. (l.c.).

*Schrankia quadrivalvis* (L.) Merr., *Philipp. J. Sc., Bot.* 5 (1910) 30; Sp. Blanc. (1918) 167; *Enum. Philipp.* 2 (1923) 250. — *Mimosa quadrivalvis* L., *Sp. Pl.* (1753) 522; Blanco, *Fl. Filip.* (1837) 732.

*Schrankia aculeata* Willd., *Sp. Pl. ed. 4*, 4 (1806) 1041; F.-Vill., *Novis. App.* (1880) 74.

Apparently introduced to the Philippines by the Spanish from Mexico (Merrill 1910, 1918). I have seen only the specimens cited by Merrill (1923) and doubt that the species ever established in Malesia, though it has shown some persistence at Bauang, Batangas Province, Luzon, where it was recollected in 1915 by Merrill, the first collection from that place being that of Blanco before 1837 (Merrill 1918).

*Xylia xylocarpa* (Roxb.) Taub. in E. & P., *Nat. Pflanzenfam.* 3, 3 (1891) 121; Burkill, *Dict.* 2 (1935) 2315.

A species of India, Burma, Thailand and Indochina which has been cultivated experimentally in Singapore, but never established in cultivation.

## CULTIVATED MIMOSOIDEAE

Several *Mimosoideae* are cultivated in Malesia. Most of them are of tropical American origin, but many *Acacia* species have been introduced from Australia. Widely established and naturalized species (e.g., *Acacia farnesiana*, *Leucaena leucocephala*), dealt with in the floristic account, are only mentioned with a reference to the page where they are treated. All genera have been included in the main keys (p. 28–34), as it might be impossible for the inexperienced botanist to judge if a species is cultivated or not before she/he knows the identity of the species.

The species have been introduced for a wide range of purposes as, e.g., shade trees, fertilizers, cover-crops, ornamentals, timber trees, and fodder plants, many species serving several purposes.

## ENUMERATION OF CULTIVATED SPECIES

## Tribus Acacieae

**Acacia auriculiformis** A. Cunn. ex Benth. — See page 58.

**Acacia baileyana** F. Muell., Trans. Roy. Soc. Vic. 24 (1888) 168; Icon. Austral. Acacia 12 (1888) 5; Maiden, For. Fl. N.S.W. 4 (1911) 8; Newman, Proc. Linn. Soc. N.S.W. 60 (1935) 428; Backer & Bakh. f., Fl. Java 1 (1963) 558; Pedley, Austrobaileya 1 (3) (1979) 301. — *Racosperma baileyianum* (F. Muell.) Pedley, Austrobaileya 2 (4) (1987) 345.

Small, unarmed tree to 3 m high. Branchlets angular, glabrous or pubescent. Leaves bipinnate, glaucous, pinnae and leaflets approximate, leaves consequently making an impression of being entire, rachis 1–3 cm, petiole 0.1–0.2 cm, glabrous to tomentose, rachis glands at junction of pinnae, circular, concave, c. 1 mm in diameter; pinnae 2–4(–6) pairs, 1–2.5 cm; leaflets opposite, sessile, (4–)12–24 pairs per pinna, linear, often slightly curved, 3–8 by 0.7–1.6 mm, glabrous. Inflorescences 6–12.5 cm long racemes with flower heads of 10–20 flowers, much longer than the leaves, the terminal racemes often aggregated into a panicle, rachis glabrous or subglabrous. Pod strap-shaped, 5–10.5 by 0.9–1.2 cm, 10–13-seeded, funicle short.

Distribution – Australia (New South Wales), introduced in the mountain districts of Java, where it is sometimes cultivated as an ornamental; at c. 1500 m altitude.

**Acacia catechu** (L.f.) Willd., Sp. Pl. ed. 4, 4 (1806) 1079; Miq., Fl. Ind. Bat. 1 (1855) 9; Heyne, Nutt. Pl. Ned. Ind. 2 (1916) 215; Burkill, Dict. 1 (1935) 15; Backer & Bakh. f., Fl. Java 1 (1963) 557; Ali, Fl. W. Pakistan 36 (1973) 5. — *Mimosa catechu* L.f., Suppl. Plant. (1781) 439.

Tree to 15 m high. Branchlets puberulous, armed with paired, to 1 cm long recurved prickles just below the nodes. Stipules subulate, inconspicuous. Leaves bipinnate, rachis c. 7–17 cm, pilose, petiole gland at or 0.7 cm below the junction of the proximal pair of pinnae, circular to elliptic, flat to concave with raised margins, 1–2.5 mm long; pinnae 9–30 pairs, leaflets (13–)18–50 pairs, opposite, sessile, linear, (2.5–)3.5–6.5 by 0.5–1(–1.5) mm, glabrous with ciliate margins. Inflorescences consisting of axillary clusters of

1–4 pedunculate spikes, 6–13 cm long. Pod glossy brown, chartaceous, strap-shaped (1–)4–14 by (0.8–)1.1–2.4 cm, flat and swollen over the seeds, beaked, with prominent, reticulate, transverse veins. Seeds 3–10, funicle once contorted.

Distribution – W Pakistan to Burma; altitude sea-level up to c. 1200 m. In Malesia introduced in the monsoon areas of Java.

Uses – This is the 'Kutch' or 'Kath' of India. The tannin is extracted by boiling the heartwood of the tree. The purest tannin, the 'kath' is used for chewing with betel. The wood is reddish, durable, resistant to termites (Burkill, l.c.).

**Acacia confusa** Merr. — See page 61.

**Acacia cultriformis** A. Cunn. ex G. Don, Gen. Syst. 2 (1832) 406; Hook., Ic. Pl. (1838) t. 170; Benth., Fl. Austral. 2 (1864) 375; Trans. Linn. Soc. 30 (1875) 474; Bailey, Qld. Fl. 2 (1900) 493; Backer & Bakh. f., Fl. Java 1 (1963) 559; Pedley, Austrobaileya 1 (3) (1979) 277. — *Racosperma cultriforme* (A. Cunn. ex G. Don) Pedley, Austrobaileya 2 (4) (1987) 347.

Unarmed shrub to c. 4 m. Branchlets regular, glabrous. Phyllodes crowded along branches, coriaceous, lower margin straight or slightly curved, upper margin sharply curved, glabrous, 2–3 by 1–1.4 cm, 2–2.5 times as long as wide, glabrous, gland at or slightly below the broadest part of the phyllode, pustular, with a rather large orifice, main vein close to the lower margin, reticulation penni-veined. Inflorescence consisting of heads of 25–35 flowers in axillary glabrous racemes. Flowers pentamerous, bisexual. Pod flat, glaucous, raised over the seeds, 5–7 by 0.7 cm. Seeds longitudinal, 3.5 by 2.3 mm; areole almost closed, funicle not folded but thickened into a clavate aril beneath the seed.

Distribution – Australia (S Queensland, New South Wales, Tasmania). In Malesia sometimes planted in the mountains of W Java as an ornamental.

**Acacia deanei** (R.T. Baker) Welch, Coombs & McGlynn, Proc. Roy. Soc. N.S.W. 65 (1932) 227; Verdc., Manual New Guin. Legum. (1979) 166. — *Acacia decurrens* Willd. var. *deanei* R. Baker, Proc. Linn. Soc. N.S.W. 21 (1896) 348. — *Racosperma deanei* (R. Baker) Pedley, J. Linn. Soc. Bot. 92 (1986) 248.

Small, unarmed tree or shrub to 6 m. Branchlets slightly ribbed and as the young shoots and inflorescences with a yellowish indumentum of dense appressed hairs. Leaves bipinnate, rachis and pinnae with moderate to dense appressed indumentum, rachis 3–5.5 cm, petiole 1–1.5 cm, rachis glands at or slightly below the junction of the pinnae, thickly rimmed, 1 or 2 extra glands occasionally between the junctions; pinnae 6–12 pairs, 1.5–3 cm; leaflets opposite, sessile, 18–30 pairs, oblong-linear, 2.4–3(–4) by 0.6–1 mm, thick, obtuse, upper surface glabrous, lower usually densely appressed puberulous. Inflorescences consisting of 20–25-flowered heads, aggregated into 4–14 cm panicles. Pods linear, flat, slightly concave over the seeds, c. 10 by 0.5 cm, with an indumentum of short appressed white hairs, funicle expanded into a cupular aril below the seed.

Distribution — Australia (S inland Queensland, New South Wales). In Malesia introduced and cultivated as an ornamental in Papua New Guinea.

**Acacia decurrens** Willd., Sp. Pl. ed. 4, 4 (1806) 1072; Blume, Cat. (1823) 86, p.p.; Miq., Fl. Ind. Bat. 1 (1855) 5, p.p.; Heyne, Nutt. Pl. Ned. Ind. 2 (1916) 216, p.p.; Burkill, Dict. 1 (1935) 17, p.p.; Backer & Bakh. f., Fl. Java 1 (1963) 557, p.p.

Unarmed, glabrous, spreading tree to 12 m. Branchlets acutely angular. Leaves bipinnate, rachis 7–12 cm, gland at top of petiole, circular, raised, thickly rimmed, c. 1 mm diam.; pinnae 6–8(–12) pairs, 3–6 cm; leaflets opposite sessile, 30–40 pairs, widely spaced, linear-filiform, acute, glabrous, 5–10 by 0.5 mm. Inflorescences consisting of 25–30-flowered heads, aggregated in axillary racemes, exceeding the leaves. Pod oblong, compressed 5–10 by 0.4–0.7 cm, constricted between the seeds.

Distribution — Subtropical Australia. In Malesia introduced and cultivated in the mountains of W Java. Also known as 'Black Wattle'.

Note — Most of the specimens formerly referred to this species in the herbaria belong to the Australian species *A. dealbata* and *A. mearnsii*.

**Acacia elata** A. Cunn. ex Benth., Lond. J. Bot. 1 (1842) 383; Backer & Bakh. f., Fl. Java 1 (1963) 557.

Unarmed tree, 15–25 m. Branchlets terete, finely puberulous. Leaves bipinnate, rachis and pinnae very sparsely puberulous; rachis 11–17 cm, petiole 8 cm, gland at about the middle of the petiole, elliptic in outline, with a very narrow orifice, c. 4

mm, distal part of rachis glandular; pinnae 2–4 pairs, 8–14 cm, leaflets opposite, subsessile, 8–14 pairs per pinnae, rigidly chartaceous, ovate-oblong, lanceolate-falcate or ovate-lanceolate, bent forwards, acuminate-caudate, acute, 2.9–4.2 by 0.4–0.9 cm, both surfaces scarcely appressed puberulous. Inflorescences consisting of pedunculate glomerules, c. 0.4–0.5 cm diam., aggregated in axillary racemes or terminal panicles. Pod oblong, 10–15 by 1.25 cm, funicle short.

Distribution — Australia (New South Wales). In Malesia (Java) sometimes cultivated for green manure in *Cinchona* plantations. With whitish flowers, and foliage reminding of *Schinus molle*.

**Acacia falcata** Willd., Sp. Pl. ed. 4, 4 (1806) 1053; Benth., Fl. Aust. 2 (1864) 361; Trans. Linn. Soc. 30 (1875) 468; Backer & Bakh. f., Fl. Java 1 (1963) 560; Pedley, Austrobaileya 1 (3) (1979) 266. — *Racosperma falcatum* (Willd.) Mart., Hort. Reg. Monac. Sem. (1835).

Unarmed, erect shrub or tree up to 4 m high. Branchlets with not very prominent yellowish rib. Phyllodes falcate, glabrous with prominent main vein and margins, reticulately penninerved, acute or obtuse, broadest above the middle, very attenuate at the base, (9.5–)12–19 by 1.2–4 cm, 4.5–12 times as long as broad, with a slit-like gland at the base, pulvinus c. 5 mm. Inflorescences consisting of heads of 15–20 yellow flowers in axillary racemes. Pods linear, ± flat, with nerve-like margin and transverse reticulate veins, to c. 10 by 0.5–0.7 cm. Seeds 2–2.2 by 0.8–1 mm, pleurogram closed, funicle running round the top of the seed to the base, then folded back and thickened to form a clavate aril on one side at the base.

Distribution — Australia; in Malesia cultivated in the mountain regions of Java.

**Acacia farnesiana** (L.) Willd. — See page 44.

**Acacia flavescens** A. Cunn. ex Benth., Lond. J. Bot. 1 (1842) 381; Fl. Austral. 2 (1864) 391; Trans. Linn. Soc. 30 (1875) 483; Pedley, Austrobaileya 1 (2) (1978) 217; Verdc., Manual New Guin. Legum. (1979) 168. — *Racosperma flavescens* (A. Cunn. ex Benth.) Pedley, Austrobaileya 2 (4) (1987) 348.

Unarmed tree to 10 m high. Branchlets angular, with moderately dense stellate hairs. Phyllodes ovate, falcate, acute, usually long-tapering, 9–24 by (1–)2–4(–5.5) cm, 3–6(–9.5) times as long as wide, with 3 prominent longitudinal veins, the



upper two ending at the margin at an indentation, usually associated with a gland, the adaxial one ending at the apex, nerves finely transversely reticulate; basal gland prominent with distinct rim and elongate orifice, 2 mm, and in addition 3 or more smaller but conspicuous glands in indentations along upper margin, pulvinus rather long. Flowering heads of (30–)40–50 flowers, grouped in terminal or sometimes compound panicles, up to 30 cm wide, densely yellowish hairy. Flowers yellow, pentamerous, bisexual. Pod flat, slightly winged, shining, with transverse veins and scattered hairs when young, 6–12 by 1.5–2 cm. Seeds transverse, c. 6 by 4 mm, pleurogram large, open; funicle ribbon-like, folded and finally expanded into cupular aril.

Distribution – Australia (Queensland); in *Malesia* cultivated in Papua New Guinea.

**Acacia floribunda** (Vent.) Willd., Sp. Pl. ed. 4, 4 (1806) 1051; Pedley, *Austrobaileya* 1 (2) (1978) 166. — *Mimosa floribunda* Vent., *Choix des Pl.* (1803) t. 13. — *Acacia longifolia* (Andr.) Willd. var. *floribunda* (Vent.) F. Muell., Pl. Vict. 2 (1863) 31; Benth., Fl. Austral. 2 (1864) 398; Trans. Linn. Soc. 30 (1875) 487. — *Racosperma floribundum* (Vent.) Pedley, *Austrobaileya* 2 (4) (1987) 348.

Unarmed tree to c. 8 m high. Branchlets angular, with short white appressed hairs. Phyllodes straight, narrow-lanceolate, acute, 5–10 by (0.2–) 0.4–1 cm, 8–18(–35) times as long as wide, appressed puberulous, glabrescent; gland not prominent, 0.4–0.6 cm above the base of the phyllode or absent; 1–3 prominent longitudinal veins, 6–9 anastomosing secondary veins on each side of the midrib. Spikes sparsiflorous,  $\pm$  sessile, to c. 8 cm, glabrous. Flowers yellow, tetramerous, bisexual. Calyx cupular, 0.2–0.5 mm,  $\pm$  glabrous, lobes short, obtuse,  $\pm$  ciliate. Corolla 1.4–2 mm. Ovary pubescent with long white hairs. Pod straight, linear, longitudinally wrinkled and somewhat moniliform, c. 13 by 0.3 cm. Seeds longitudinal, 4–5 by c. 1.5 mm; pleurogram large, open; funicle folded.

Distribution – Australia (Queensland, New South Wales); in *Malesia* introduced, not naturalized, in W Java, Malaya (Pahang), N Sumatra. Altitude 1100–c. 1400 m.

**Acacia glauca** (L.) Moench., Meth. Pl. (1794) 466, p.p., quoad nomen; De Wit, Taxon 10 (1961) 53; Fournet, Fl. Guadeloupe et Martinique (1978) 704. — *Mimosa glauca* L., Sp. Pl. (1753) 520.

*Mimosa villosa* Sw., Fl. Ind. Occ. 2 (1800) 982. — *Acacia villosa* (Sw.) Willd., Sp. Pl. ed. 4, 4 (1806) 1067; Benth., Trans. Linn. Soc. 30 (1875) 532; Fawc. & Rendle, Fl. Jamaica 4, 2 (1920) 141; Burkill, Dict. 1 (1935) 24; Adams, Fl. Pl. Jamaica (1972) 336. — *Acaciella villosa* (Sw.) Britton & Rose, N. Amer. Fl. 23, 2 (1928) 104; Backer & Bakh. f., Fl. Java 1 (1963) 557 (forma *glabra* Backer).

Erect unarmed shrub or small tree, 2–4 m high. Stipules caducous. Branchlets terete, longitudinally striate. Leaves bipinnate (or tripinnate in the top of the twigs), rachis and pinnae eglandular, rachis 8–12 cm, pinnae 2–8(–10) pairs, 4–7 cm; leaflets 10–30 pairs per pinna, opposite, sessile, membranous, oblong-lanceolate, unequal-sided, 4–8 by 1–2 mm, base half truncate/half cuneate, apex acute, both surfaces puberulous to glabrescent, main vein subdiagonal, lateral veins inconspicuous. Inflorescences consisting of pedunculate 20–40-flowered capitate racemes, 2–6 together in the distal leaf axils, or aggregated in terminal racemes; peduncle up to 2.5 cm, pedicel 1–2 mm, articulated. Flowers white turning yellowish, pentamerous. Calyx 0.5–1 mm. Corolla 2–2.5 mm. Stamens numerous. Pod brown, flat, membranous, oblong to strap-shaped, apiculate, swollen over the seeds and with distinct transverse veins in the marginal parts of the pod, 1.5–10 by 0.5–1.5 cm, stalk c. 1 cm. Seeds transverse, funicle long, slender.

Distribution – Jamaica; cultivated all over the tropics as an ornamental. Said to be naturalized in the Philippines (PNH 7014). Tried as cover plant in teak and tea plantations. In *Malesia* found at altitudes up to 1100 m.

**Acacia holosericea** A. Cunn. ex G. Don, Gen. Syst. Gard. Dict. 2 (1832) 407; Bailey, Syn. Qld. Fl. (1883) 143; Qld. Fl. 2 (1900) 512; Pedley, Proc. Roy. Soc. Qld. 7 (1964) 57; *Austrobaileya* 1 (2) (1978) 181; Verdc., Manual New Guin. Legum. (1979) 169. — *Racosperma holosericeum* (A. Cunn. ex G. Don) Pedley, *Austrobaileya* 2 (4) (1987) 349.

Unarmed shrub or small tree, 3–6(–9) m high, with spreading branches. Branchlets sharply angled, glabrous, sericeous, or tomentose. Phyllodes straight to falcate, elliptic-oblong to elliptic-lanceolate, 9–21 by 1.5–5(–13) cm, with a thick mucro at the apex, obliquely cuneate at the base, softly silvery sericeous, pulvinus 0.5–1.2 cm, gland at the base of the phyllode, elliptic, with raised margin, c. 3 mm, main vein at the basiscopic margin for a short distance, dividing into 3 or 4 main veins, of which 2 starting from the

apex, secondary veins reticulate. Spikes with flowers moderately crowded, 3–7 by c. 0.4 cm, 1–3 together in the upper leaf-axils; peduncles sericeous or tomentose, but rachis glabrescent. Flowers yellow, slightly scented, pentamerous, bisexual. Calyx, 0.5–0.7 mm, sericeous to tomentose; lobes obtuse, c. 0.15 mm. Corolla c. 1.5–2.1 mm, sparsely sericeous or tomentose, divided nearly to the base, lobes elliptic, acute, c. 1.5 mm. Stamens c. 3–4 mm. Ovary sessile, sericeous. Pod purple brown or blackish, densely contorted, forming curly masses; valves chartaceous to subwoody, 2.5–5 mm wide, bullate over the seeds, glabrous or puberulous, veins inconspicuous. Seeds rectangular-obovate-elliptic, glossy dark brown, 3.5–5 by 2.5 mm; pleurogram oblong, 1.5 mm, open towards the hilum.

Distribution – Tropical Australia (W Australia, Northern Territory, Queensland); in *Malesia* introduced as a street tree. Bark grey to black, rather rough-fissured. Altitude up to 2500 m.

***Acacia linifolia*** (Vent.) Willd., Sp. Pl. ed. 4, 4 (1806) 1051; Benth., Fl. Austral. 2 (1864) 371; Trans. Linn. Soc. 30 (1875) 472; Backer & Bakh. f., Fl. Java 1 (1963) 559. — *Mimosa linifolia* Vent., Pl. Rar. Hort. Cel. (1800) 2, t. 2.

Unarmed erect shrub. Branchlets conspicuously angular, glabrous. Phyllodes linear or slightly widened distally, with a small apical point, glabrous, rather thin, 2–4 by 0.2–0.3 cm, one-veined, slightly penniveined, the slender vein-like margins and main vein often minutely ciliate, with a small gland above the base. Flowering heads grouped into axillary erecto-patent racemes, during anthesis not or hardly exceeding the floral phyllodes, later on growing longer. Pod 4–10 by 0.8–1.2 cm, impressed between the seeds. Seeds longitudinal, the last fold of the funicle thickened into a club-shaped lateral aril, the other folds minute.

Distribution – Australia (New South Wales); in *Malesia* cultivated in the mountain regions of W Java.

***Acacia longifolia*** (Andr.) Willd., Sp. Pl. ed. 4, 4 (1806) 1052; Benth., Fl. Austral. 2 (1864) 397, p.p., quoad forma c. typica; Trans. Linn. Soc. 30 (1875) 487; Bailey, Syn. Qld. Fl. (1883) 140; Qld. Fl. (1900) 504; Backer & Bakh. f., Fl. Java 1 (1963) 558. — *Mimosa longifolia* Andr., Bot. Rep. (1802) t. 207.

Unarmed shrub or tree, up to 10 m high. Branchlets acutely trigonous, older ones angular and ribbed, glabrous. Phyllodes variable as to shape and size, oblong-lanceolate to narrowly linear, straight

or slightly curved, 4–16 by 0.3–2.5 cm, acute or obtuse, with 1–5 main veins, secondary veins anastomosing. Spikes loose and interrupted, 1–3 in the distal leaf-axils, 2–5 cm. Flowers yellow, fragrant, tetramerous, bisexual. Pod linear, straight or slightly curved, 2.5–15 by 0.5–0.6 cm, valves coriaceous, convex over the seeds, usually contracted in between. Seeds longitudinal, funicle not folded, thickened almost from the base into a turbinate, almost cup-shaped aril at the base of the seed and sometimes nearly as large.

Distribution – Australia (extratropical E Australia, Tasmania); in *Malesia* introduced, not naturalized, in the mountain regions of W Java.

Note – According to Bentham (1864: 393) and Pedley [Austrobaileya 1 (2) (1978) 164, 166] not yet fully revised species.

***Acacia longispicata*** Benth. in Mitch., Trop. Austral. (1848) 298; Pedley, Contr. Qld. Herb. 15 (1974) 9; Austrobaileya 1 (2) (1978) 176. — *Acacia cunninghamii* Hook. var. *longispicata* (Benth.) Benth., Fl. Austral. 2 (1864) 407. — *Racosperma longispicata* (Benth.) Pedley, Austrobaileya 2 (4) (1987) 351.

Distribution – Australia (Queensland); in *Malesia* once introduced to Timor (bb 7241, distributed as *A. gonoclada* F. Muell.), not naturalized.

***Acacia mangium*** Willd. — See p. 59.

***Acacia mearnsii*** De Wild., Pl. Bequart. 3 (1925) 62; Verdc., Manual New Guin. Leg. (1979) 170. *Acacia decurrens* Willd. var. *mollis* Benth., Trans. Linn. Soc. 30 (1875) 496.

Unarmed shrub or tree up to 24 m high. Branchlets angular, as the foliage and inflorescences densely appressed puberulous. Leaves bipinnate, petiole with one gland and numerous raised glands along the adaxial side of the rachis; leaflets 16–70 pairs, opposite, sessile, oblong-linear, 1.5–4 by 0.5–0.75 mm, broadly acute or rounded, glabrous, main vein diagonal, lateral veins inconspicuous. Inflorescences composed of pedunculate flower-glomerules, c. 5–8 mm in diameter, aggregated in racemes or panicles axillary to the upper leaves. Pod most often moniliform with 3–12 joints, grey-puberulous, dehiscent. Seeds black, smooth, elliptic, 5 by 3.5 mm, flattened.

Distribution – Australia (New South Wales, Victoria); in *Malesia* introduced as an ornamental, but not naturalized.

Note – This is the Australian ‘Black Wattle’. Most specimens were formerly named *A. decurrens* var. *mollis* Benth.

**Acacia podalyriifolia** A. Cunn. ex G. Don, Gen. Syst. 2 (1832) 405; Benth. Fl. Austral. 2 (1864) 374; Trans. Linn. Soc. 30 (1875) 474; Bailey, Syn. Qld. Fl. (1883) 137; Qld. Fl. 2 (1900) 492; Summerh., Bot. Mag. 163 (1940) t. 9604; Backer & Bakh. f., Fl. Java 1 (1963) 559; Pedley, Austrobaileya 1 (3) (1979) 276. — *Racosperma podalyriifolium* (A. Cunn. ex G. Don) Pedley, Austrobaileya 2 (4) (1987) 354.

Unarmed tree to 5 m high. Branchlets glaucous, with dense, rigid hairs 0.4–0.6 mm, rarely glabrous. Phyllodes with dense straight hairs, sometimes glabrescent, elliptic or ovate, top acute, obtuse, or rarely retuse, mucronulate, sometimes slightly undulate, main vein closer to the dorsal margin, penniveined, 2–5 by 1–2(–2.7) cm, 1.4–2.5 times as long as wide, pulvinus 1–2 mm, with a usually inconspicuous gland, (0.5–)0.8–2 cm above the base. Heads formed of 20–30 flowers grouped in racemes, with indumentum similar to that of the branchlets. Flowers yellow, pentamerous, bisexual. Pod flat with prominent margins, up to 9 by c. 2 cm, glaucous, softly hairy. Seeds longitudinal, 6.5–7.5 by 3–4 mm, pleurogram open, funicle thickened into a clavate aril.

Distribution – Australia (Queensland); in *Malesia* widely cultivated as an ornamental.

**Acacia polybotrya** Benth., Lond. J. Bot. 1 (1842) 384; Fl. Austral. 2 (1864) 214; Trans. Linn. Soc. 30 (1875) 496; Bailey, Syn. Qld. Fl. (1883) 144; Backer & Bakh. f., Fl. Java 1 (1963) 558; Pedley, Austrobaileya 1 (3) (1979) 297. — *Racosperma polybotryum* (Benth.) Pedley, Austrobaileya 2 (4) (1987) 354.

Distribution – Australia (Queensland, New South Wales); in *Malesia* planted in the mountain districts of W Java.

**Acacia pruinosa** A. Cunn. ex Benth., Lond. J. Bot. 1 (1842) 383; Fl. Austral. 2 (1864) 413; Trans. Linn. Soc. 30 (1875) 496; Backer & Bakh. f., Fl. Java 1 (1963) 558; Pedley, Austrobaileya 1 (3) (1979) 299. — *Racosperma pruinosa* (A. Cunn. ex Benth.) Pedley, Austrobaileya 2 (4) (1987) 354.

Unarmed, little-branched shrub to 2 m tall. Branchlets terete, glabrous. Leaves bipinnate, rachis reddish, glabrous; petiole 3–5(–7.5) cm, with a gland in the distal half; rachis 2–7 cm, with glands at the junctions of all or only at the proximal pair of pinnae; pinnae 2 or 3 (or 4) pairs, 4–8 cm; leaflets opposite, sessile, 8–13 (1–15) pairs, oblong, obtuse, 9–17 by 2.5–4 mm, glabrous. Inflorescences composed of flower-heads of

20–30 flowers, aggregated in terminal panicles or arising from the upper leaf axils. Pod linear, flat, glaucous, slightly concave over the seeds, c. 7 by 0.7 cm. Seeds longitudinal, c. 5 by 3 mm; areole closed, funicle expanded into a cupular aril.

Distribution – Australia (S Queensland, New South Wales); in *Malesia* introduced, not naturalized; planted in mountain districts of W Java.

**Acacia pycnantha** Benth., Lond. J. Bot. 1 (1842) 351; Fl. Austral. 2 (1864) 365; Trans. Linn. Soc. 30 (1875) 469; Burkill, Dict. 1 (1935) 23; Backer & Bakh. f., Fl. Java 1 (1963) 560.

Unarmed small or medium-sized tree. Branchlets subterete or terete, quite glabrous as the remaining parts of the plant. Phyllodia rather long-stalked, lanceolate-falcate, top narrowed, obtuse, 7.5–15 cm, the larger ones often 2.5 cm wide in the middle, coriaceous, with one main nerve, penniveined, with vein-like margins, one marginal gland, rather large and close to the base; pulvinus long. Flowering heads composed of 50–100 flowers, in axillary and terminal racemes, those at the ends of the branches often aggregated into panicles. Pod straight or slightly curved, impressed between the seeds, 8–12 by 0.5–0.7 cm. Seeds longitudinal, ovate-oblong; funicle either not folded or with one or two very short folds at the base.

Distribution – Australia (Victoria, S Australia) ('Golden Wattle'); in *Malesia* sometimes planted in the mountain regions of W Java.

**Acacia retinodes** Schldl., Linnaea 20 (1847) 664; Benth., Fl. Austral. 2 (1864) 362; Trans. Linn. Soc. 30 (1875) 468; F. Muell., Icon. Austral. Acac. 5 (1887) 9; Backer & Bakh. f., Fl. Java 1 (1963) 559.

Unarmed, erect, often very much-branched shrub, 1–5 m high. Branchlets trigonous at the apex, when older ribbed, usually glabrous. Phyllodes lanceolate-linear, sometimes wider above the middle, with one vein, finely penniveined, 2–22 by 1(–1.3) cm; glaucous, marginal gland above the base, rarely wanting. Flowering heads composed of 30–50 flowers grouped into axillary, erecto-patent racemes, almost always branched. Flowers light yellow, pentamerous, bisexual. Pod linear, straight or slightly curved, flat, 7.5–20 by 0.8–1 cm. Seeds longitudinal, oblong, funicle dilated, extending round the seed and bent back on the same side, encircling it into a double fold.

Distribution – Australia (extratropical E Australia, Victoria, S Australia); in *Malesia*: in Java frequently cultivated as an ornamental.



***Acacia spectabilis*** A. Cunn. ex Benth., Lond. J. Bot. 1 (1842) 383; Fl. Austral. 2 (1864) 413; Trans. Linn. Soc. 30 (1875) 496; Bailey, Syn. Qld. Fl. (1883) 144; Backer & Bakh. f., Fl. Java 1 (1963) 558; Pedley, Austrobaileya 1 (3) (1979) 298. — *Racosperma spectabile* (A. Cunn. ex Benth.) Pedley, Austrobaileya 2 (4) (1987) 355.

Unarmed shrub to c. 5 m high. Branchlets glaucous, with  $\pm$  dense indumentum of spreading hairs up to 0.2 mm, glabrescent. Leaves bipinnate, with indumentum as the branchlets; petiole 0.6–1.8 cm, one gland just below the junction of the proximal pair of pinnae; rachis 2–7(–9.5) cm, glandless; pinnae 3–5(–7) pairs, 1–3 cm, leaflets opposite, sessile, 4–6(–8) pairs, oblong-obovate, obtuse, 6–11(–13) by 2.5–5 mm, getting progressively larger along pinnae and terminal ones sometimes broadest near the apex, glabrous. Inflorescences composed of flower-heads of 15–20 flowers, aggregated into long axillary racemes or rarely in terminal panicles. Pod linear, flat, convex over the seeds, glaucous, glabrous, to 11 by 1.2–1.5 cm. Seeds longitudinal, c. 6 by 3.5 mm, pleurogram constricted at the hilar end, but open; funicle expanded into a cupular aril.

Distribution — Australia (S Queensland, New South Wales); in *Malesia* sometimes planted in the mountain regions of W Java.

***Acacia stricta*** (Andr.) Willd., Sp. Pl. ed. 4, 4 (1806) 1052; Benth. Fl. Austral. 2 (1864) 358; Trans. Linn. Soc. 30 (1875) 466; Pedley, Austrobaileya 1 (3) (1979) 262. — *Mimosa stricta* Andr., Bot. Rep. (1799) t. 53. — *Racosperma strictum* (Andr.) Mart., Hort. Monac. Sem. (1835).

Unarmed shrub to c. 5 m high. Branchlets angular, with yellowish resinous ribs. Phyllodes linear-spathulate, gradually tapered to the base, apex abruptly contracted, obtuse, apiculate; main vein and margins prominent, resinous, sometimes a faint second longitudinal nerve present for a short distance on the adaxial side, and conspicuously, closely reticulately penniveined, 7.5–10.5 by 0.6–0.9 (–1.7) cm, (6–)9–13 times as long as wide, gland prominent, close to the base. Flowering heads composed of c. 25 flowers in clusters (condensed racemes with very short rachis) of 2–7 in the axils of the phyllodes. Pod linear,  $\pm$  straight, slightly glutinous, with thickened margins, to 7 by c. 2.5 cm. Seeds longitudinal, 3.5 by 1.5 mm; pleurogram large, open; funicle intricately folded, forming an aril half as long as the seed below the seed.

Distribution — Australia (S Queensland, New South Wales, Victoria, Tasmania); in *Malesia* planted in the mountain regions of Java.

***Acacia suaveolens*** (Sm.) Willd., Sp. Pl. ed. 4, 4 (1806) 1050; Benth., Fl. Austral. 2 (1864) 369; Trans. Linn. Soc. 30 (1875) 475; Backer & Bakh. f., Fl. Java 1 (1963) 559; Pedley, Austrobaileya 1 (3) (1979) 281. — *Mimosa suaveolens* Sm., Trans. Linn. Soc. 1 (1791) 253. — *Racosperma suaveolens* (Sm.) Mart., Hort. Monac. Semin. (1835).

Unarmed slender little-branched shrub to 2.5 m high. Branchlets angular, glabrous, sometimes glaucous. Phyllodes coriaceous, glabrous, straight or slightly curved, acute or obtuse, mucronate, (6–)7.5–12.5 by (0.2–)0.3–0.7(–1) cm, (9–)13–27 (–35) times as long as wide, with a small gland at or within 4 mm of the base, pulvinus 1–2 mm. Flowering heads composed of 3–7 flowers, grouped in glabrous axillary racemes. Flowers whitish green, (4–)5-merous, bisexual. Pod with a striking blue-black colour, glabrous, glaucous, oblong, obtuse, apiculate, flat but raised over the seeds, 2.5–4 by 1.3–1.7 cm. Seeds transverse, 6–7 by 3–4.5 mm, pleurogram closed; funicle 3-folded and thickened in a slightly oblique, basal aril.

Distribution — Australia (S Queensland, Tasmania) ('Sweet-scented Wattle'); in *Malesia* introduced to mountain districts of W Java.

***Acacia sutherlandii*** (F. Muell.) F. Muell., Icon. Austral. Acacia (1888) 12; Pedley, Austrobaileya 1 (3) (1979) 307. — *Albizia sutherlandii* F. Muell., Fragm. 6 (1867) 22.

Tree to c. 7 m high. Bark rough, somewhat corky. Branchlets glabrous. Stipular spines present on young plants. Leaves bipinnate; rachis 12–14 cm; pinnae (11–)15–17 pairs, 3.5–4 cm; leaflets (9–)15–25 pairs, somewhat wrinkled, linear-oblong, obtuse, 3–5 by 0.7–1.3 mm. Inflorescences composed of rather loosely flowered axillary spikes, c. 3.5 cm, peduncles c. 1 cm, bract c. 0.7 cm above the base. Calyx c. 3.5 mm, irregularly 3-lobed. Corolla slightly longer, shortly 5-lobed. Anthers with minute, stipitate gland at apex, deciduous. Ovary glabrous. Pod oblong, flat, glabrous, slightly winged on the upper margin, obscurely obliquely longitudinally veined, c. 20 by 1.7 cm. Seeds longitudinal, 11–12 by 8–10 mm, with a large open pleurogram; funicle hardly folded.

Distribution — Australia (Queensland, Northern Territory), one of the few species of subg. *Acacia* native to Australia; in *Malesia* introduced to Papua New Guinea (Port Moresby) as an ornamental.

## Tribus Ingeae

**Albizia Durazz.**

Several species, also native ones, are cultivated.  
A rarely cultivated exotic is:

**Albizia carbonaria** Britton in Britton & Wilson, Sc. Surv. P. Rico & Virgin Is. 6 (1926) 348; Nielsen, Opera Bot. 81 (1985) 47.

*Albizia sumatrana* Steen., Encycl. Ned. Ind. (ed. 1), Suppl. 6 (1931) 864; Blumea 5 (1945) 509, pl. 1; Backer & Bakh. f., Fl. Java 1 (1963) 533.

Distribution – Central America and N tropical South America.

Note – Cultivated as a shade tree in tea plantations in W Java and Sumatra; altitude 250–1300 m.

**Calliandra Benth.**

A genus of c. 180 species. Main distribution in tropical America, but species are native to Africa, Madagascar and India.

## KEY TO THE SPECIES

- 1a. Pinnae 1–3 pairs . . . . . 2
- b. Pinnae 3–10 pairs . . . . . 5
- 2a. Leaflets 2 pairs per pinna . . . . . *C. deamii*
- b. Leaflets 7–40 pairs per pinna . . . . . 3
- 3a. Leaflets 20–40 pairs per pinna . . . . . *C. brevipes*
- b. Leaflets 7–10 pairs per pinna . . . . . 4
- 4a. Leaflets narrowly oblong, up to 2 by 0.5 cm.  
Stamens with a white proximal part and a pink distal part . . . . . *C. surinamensis*
- b. Leaflets subfalcate, elliptic, lanceolate or oblong-lanceolate, 0.5–4.7 by 0.3–1.7 cm.  
Stamens blood-red . . . . . *C. haematocephala*
- 5a. Leaflets 7–10 pairs per pinna  
*C. surinamensis*
- b. Leaflets 20–40(–60) pairs per pinna . . . . . 6
- 6a. Single flowers sessile . . . . . *C. portoricensis*
- b. Flowers pedicellate . . . . . 7
- 7a. Flowers glabrous . . . . . *C. calothyrsus*
- b. Corolla densely brown hairy outside  
*C. sancta-pauli*

**Calliandra brevipes** Benth., J. Bot. 2 (1840) 140; Backer & Bakh. f., Fl. Java 1 (1963) 555.

Shrub to 3 m high. Filaments with a white proximal part and a pink distal part. Pod 3–5 by c. 0.7 cm.

Distribution – Tropical and subtropical South America.

Note – Cultivated as an ornamental; altitude up to 1200 m.

**Calliandra calothyrsus** Meissner, Linnaea 21 (1848) 251; McVaugh, Fl. Novo Galiciana 5 (1987) 153.

Shrub or small tree to 6 m high. Filaments purple-red all over. Pod 7–11 by 1–1.3 cm.

Distribution – Central America and Mexico.

Note – During the last 35 years plantations of this species have been expanding in Java and now cover more than 30,000 ha. The trees are fast growing, reaching heights of up to 3.5 m in 6–9 months. The plants can be cut after the first year, yielding 5–20 m<sup>2</sup> of fuelwood per ha. The cut stumps coppice readily and the plants can be harvested annually for 15–20 years yielding 35–65 m<sup>2</sup> per year per ha [Nat. Acad. Sc.: Tropical Legumes, Res. Fut. (1979) 197].

**Calliandra deamii** (Britton & Rose) Standley, Publ. Field Mus. Nat. Hist. Chicago, Bot. Ser. 4 (1929) 309; Verdc., Manual New Guin. Legum. (1979) 174.

Shrub to c. 1.8 m high. Filaments white at the extreme base, crimson for most of the length. Pod c. 10 by 0.6 cm.

Distribution – Central America.

Note – Ornamental.

**Calliandra haematocephala** Hassk., Retzia 1 (1855) 216; Hort. Bog. Descr. (1858) 260; Backer & Bakh. f., Fl. Java 1 (1963) 554; Nevling & Elias, J. Arnold Arbor. 52 (1971) 69; Verdc., Manual New Guin. Legum. (1979) 174.

Shrub to c. 3 m high. Filaments blood-red. Pods 9–10 by 1.5 cm

Distribution – Tropical South America.

Note – Widely cultivated as an ornamental.

**Calliandra portoricensis** (Jacq.) Benth., Lond. J. Bot. 3 (1844) 99; Backer & Bakh. f., Fl. Java 1 (1963) 555. — *Mimosa portoricensis* Jacq., Collect. 4 (1791) 143. — *Zapoteca portoricensis* (Jacq.) Hernández, Ann. Missouri Bot. Gard. 73 (1986) 758; *ibid.* 76 (1989) 818.

Erect or scandent shrub to 3(–7) m high. Filaments white. Pod to 16.5 by 0.5–1 cm.

Distribution – Central and tropical South America and Caribbean area.

Note – A very variable species; cultivated as an ornamental.

**Calliandra sancta-pauli** Hassk., Retzia 1 (1855) 145, 214; Hort. Bog. Descr. (1858) 257; Backer & Bakh. f., Fl. Java 1 (1963) 555.

Erect shrub to 4 m high. Filaments with a white proximal part and a red distal part. Pod 6–9 by 0.9–1.1 cm.

Distribution – Tropical South America.

Note – Ornamental.

**Calliandra surinamensis** Benth., Lond. J. Bot. 3 (1844) 105; Verdc., Manual New Guin. Legum. (1979) 176.

Shrub or small tree to 6 m high. Staminal tube white. Filaments with crimson free parts. Pod up to 10.5 by 1.3 cm.

Distribution – North tropical South America.

Note – Common ornamental.

**Enterolobium cyclocarpum** (Jacq.) Griseb., Fl. Brit. W. Ind. (1860) 226; Verdc., Manual New Guin. Legum. (1979) 206.

Tree 15–30 m high, crown thin and spreading, up to 45 m wide. Leaves with 4–9 pairs of pinnae, each with 13–30 pairs of leaflets; leaflets narrowly oblong, acute at apex, 0.8–1.3 by 0.2–0.4 cm. Flowers in glomerules, white or greenish. Pod blackish brown, flat, curved into a circle or spiral, 7–12.5 cm in diameter. Seeds arranged into two rows, dark brown, compressed ovoid-ellipsoid, 13–19 by 11 by 8 mm, with pleurogram.

Distribution – Central and northern tropical South America.

Note – Widely cultivated in all tropics. Cultivated specimens seen from Singapore and Papua New Guinea.

**Inga** Mill.

#### KEY TO THE SPECIES

1a. Leaf-rachis broadly winged . . . . . *I. edulis*

b. Leaf-rachis unwinged . . . . . *I. laurina*

**Inga edulis** Mart., Flora 20 (1839) Beibl. 113; Backer & Bakh. f., Fl. Java 1 (1963) 549.

Tree to 12 m high. Flowers in spikes, white. Pod brown, c. 30–100 by 4.5 cm, with a sweet pulp.

Distribution – Tropical America.

Note – Ornamental with edible fruit pulp.

**Inga laurina** (Swartz) Willd., Sp. Pl. ed. 4, 4 (1806) 1018; Backer & Bakh. f., Fl. Java 1 (1963) 549. — *Mimosa laurina* Swartz, Prod. (1788) 85.

Tree to c. 15 m high. Flowers in spikes, white. Pod brown, oblong flat, up to 15 by 3.5 cm, with the seeds embedded in a sugary pulp.

Distribution – West Indies.

Note – Widely cultivated as an ornamental and for the sweet pulp.

**Paraserianthes falcataria** (L.) Nielsen — See p. 151.

**Paraserianthes lophantha** (Willd.) Nielsen — See p. 149.

**Pithecellobium dulce** (Roxb.) Benth. — See p. 155.

**Pithecellobium unguis-cati** (L.) Benth. — See p. 155 (key) and Bačker & Bakh. f., Fl. Java 1 (1963) 551.

**Samanea saman** (Jacq.) Merr. — See p. 156.

### Tribus Mimoseae

**Adenanthera malayana** Kosterm. — See p. 170.

**Adenanthera microsperma** Teijsm. & Binnend. — See p. 172.

**Adenanthera pavonina** L. — See p. 173.

**Desmanthus virgatus** (L.) Willd., Sp. Pl. ed. 4, 4 (1806) 1047; Miq., Fl. Ind. Bat. 1 (1855) 44; Verdc., Manual New Guin. Legum. (1979) 143. — *Mimosa virgata* L., Sp. Pl. (1753) 519.

Erect or ascending herb or subshrub up to c. 2 m high; stem woody at base, angular, glabrous or slightly puberulous. Stipules linear, subulate,

2.5–6 mm. Leaves: petiole 2.5–5 cm, with a gland at the junctions of the proximal pair of pinnae; pinnae 1–7 pairs; leaflets 10–25 pairs per pinna, linear-oblong, c. 4–9 by 1–2 mm, base oblique, apex obtuse or apiculate; both surfaces glabrous, margins ciliate. Glomerules consisting of up to 10 flowers. Calyx cup-shaped, c. 2 mm, indented to about half of its length. Petals oblong, c. 4 mm. Stamens 10. Pod reddish brown, linear, 5–9 by 0.3–0.4 cm, apiculate, glabrous, 20–30-seeded.

Distribution – Tropical America.

Note – Widely cultivated in the tropics as a cover crop and for fodder despite weedy tendencies. Recorded from the Solomon Islands (Verdcourt l.c.).



**Leucaena leucocephala** (Lam.) De Wit — See p. 182.

**Leucaena pulverulenta** (Schldl.) Benth., J. Bot. 4 (1842) 417; Britton & Rose, N. Am. Fl. 23 (1928) 129; Isely, Mem. N.Y. Bot. Gard. 25 (1973) 96; Backer & Bakh. f., Fl. Java 1 (1963) 560. — *Acacia pulverulenta* Schldl., Linnaea 12 (1838) 571.

Tree to 12 m high. Young branches, leaves and peduncles densely whitish pubescent, glabrescent. Pinnae 10–20 pairs, leaflets 15–30 pairs, linear, acute or obtuse, 2–6 mm long. Glomerules oblong, 1–2 cm in diameter, yellowish white; flowers densely white-strigose. Pods linear, c. 10–27 by 1.6–1.9 mm.

Distribution — Mexico, S Texas.

Note — The young branches are not angular-ribbed as stated by Backer & Bakhuizen f. (l.c.). The species has been recorded from the area around Bandung, W Java, at an altitude of c. 700 m.

**Mimosa bimucronata** (DC.) O. Kuntze — See p. 184.

**Mimosa diplotricha** C. Wright ex Sauvalle var. **diplotricha** & var. **inermis** (Adelb.) Veldk. — See p. 184 & 185 respectively.

**Mimosa scabrella** Benth., J. Bot. 4 (1842) 387; Burkart, Las Leguminosae Arg. ed. 2 (1952) 125; Fl. Illus. Catarinense, Legum. Mimos. (1979) 179, f. 27–29; Verdc., Manual New Guin. Legum. (1979) 154.

A quick-growing, unarmed tree to 15–20 m high, characterized by a dense indumentum of stellate hairs on the leaflets.

Distribution — SE Brazil, Argentina.

Note — Imported in Malesia (Papua New Guinea) as a shade tree in coffee plantations (Verdcourt l.c.). The wood is suitable for plywood and paper pulp (Burkart 1979).

**Mimosa quitensis** Benth., J. Bot. 4 (1842) 408.

Shrub with 6–12 pairs of pinnae, each with 12–20 pairs of leaflets.

Distribution — Ecuador.

Note — Once found in Java by Buysman (no 18).

**Neptunia oleracea** Lour. — See p. 189.

**Neptunia plena** (L.) Benth., J. Bot. 4 (1842) 355; Miq., Fl. Ind. Bat. 1 (1855) 50; Backer & Bakh. f., Fl. Java 1 (1963) 562; Windler, Austral. J. Bot. 14 (1966) 398; Stone, Malay. Nat. J. 37 (1984) 188. — *Mimosa plena* L., Sp. Pl. (1753) 519.

Herb with usually erect or ascending, branched stems. Leaves with a suppressed gland between or just below the lowest pair of pinnae; leaflets frequently more than 20 pairs per pinna. Seeds 8–20.

Distribution — Tropical America.

Note — An American species already collected in the Botanical Gardens Bogor in 1846 by Zollinger, but never naturalized there. In a recent report Stone (l.c.) stated that it has now become a pest in pineapple plantations in Johore, Malaya. It has been recorded also from India (Windler, l.c.).

### Prosopis L.

A genus of c. 44 species, one in Africa, three in the Middle East–NW India, the rest American.

The genus was revised by Burkart, J. Arnold Arbor. 57 (1976) 219. It is notoriously difficult to identify material to species. As many species are very often tried in cultivation, the work of Burkart should be used at identification. The key below has been compiled from Verdc., Manual New Guin. Legum. (1979) 139 and Burkart (l.c.).

#### KEY TO THE SPECIES

- 1a. Petals internally villous. Stipular thorns never present ..... *P. cineraria*
- b. Petals glabrous. Stipular thorns usually present ..... 2
- 2a. Leaves with 1–2(–4) pairs of pinnae, each with (6–)12–25(–29) pairs of leaflets; leaflets 0.6–1.6(–2.3) by 1.5–3.2(–5.5) mm *P. juliflora*
- b. Leaves with (1–)3–4 pairs of pinnae, each with 6–15 pairs of leaflets; leaflets 2.5–8.3 by 1.4–4 mm ..... *P. pallida*

**Prosopis cineraria** (L.) Druce, Rep. Bot. Soc. Exch. Cl. Brit. Isles 1913, 3 (1914) 422; Backer & Bakh. f., Fl. Java 1 (1963) 563; Burkart, J. Arnold Arbor. 57 (1976) 450. — *Mimosa cinerea* L., Sp. Pl. ed. 2, 2 (1763) 1500.

*Prosopis spicigera* L., Mant. Pl. (1767) 68; Miq., Fl. Ind. Bat. 1 (1855) 49; Heyne, Nutt. Pl. Ned. Ind. 2 (1916) 223.

Tree or shrub to 6.5 m high; prickles internodal, scattered, straight and somewhat acroscopic. Pinnae 1–3 pairs; leaflets 7–14 pairs per pinna, 4–15 by 2–4.5 mm. Pod slender, elongate, 8–19 by 0.4–0.7 cm, subcylindric-torulose. Seeds distant, ovoid, c. 6 mm long.

Distribution — Arabia to India.

Notes — In *Malesia* cultivated in Java. In its area of origin it thrives best where the rainfall is less than 750 mm/year.

Contains tannin. Used for firewood.

***Prosopis juliflora*** (Sw.) DC., Prod. 2 (1825) 447; Backer & Bakh. f., Fl. Java 1 (1963) 563; Burkart, J. Arnold Arbor. 57 (1976) 499; Verdc., Manual New Guin. Legum. (1979) 141. — *Mimosa juliflora* Sw., Prod. (1788) 85.

*Prosopis vidaliana* Naves, Ephen. 'Oriente' (1877) fide F.-Vill., *Prosopis vidaliana* (1877) 1–19, t. 1, 2; Merr., Enum. Philipp. 2 (1923) 251.

Flat-topped spiny deciduous tree or shrub to 12 m high, with rough furrowed grey or brown bark and yellowish inner bark. Flowers 4–5 mm long, in crowded, cylindrical inflorescences, 5–10 (–15) cm; corolla pale yellow. Fruits pale yellowish brown, linear, straight or slightly curved, 8–29

by 0.8–1.7 cm, thick but compressed. Seeds brown, ovoid, c. 6 mm long, embedded in a whitish, slightly sweet pulp.

Distribution — SW United States to Central and South America.

Note — Widely cultivated and naturalized in the tropics. In *Malesia* cultivated in Java, in the Philippines and Papua New Guinea.

***Prosopis pallida*** (H. & B. ex Willd.) H. B. K., Nov. Gen. Sp. Pl. 6 (1823) 309; Burkart, J. Arnold Arbor. 57 (1976) 486; Verdc., Manual New Guin. Legum. (1979) 141. — *Acacia pallida* H. & B. ex Willd., Sp. Pl. ed. 4, 4 (1806) 1059.

Tree or shrub to 10 m high, with many branches from ground level, unarmed or spiny, with short, axillary, uninodal, geminate, divergent spines less than 4 cm long; bark deeply longitudinally fissured, brown; flowers c. 6 mm long in inflorescences 7–11 cm long. Corolla yellowish green. Pod cylindrical, 6–25 by 1–1.5 cm, compressed with close anastomosing ribs. Seeds brown, oblong, 6.5 mm long.

Distribution — NW tropical South America.

Note — Burkart (l.c.) noted that this is an excellent tree for ornamental use and as a shelter under hot, arid conditions; also used for timber, fuel and the fruits for forage.

## Tribus Parkieae

***Parkia speciosa*** Hassk. — See p. 198.

***Parkia timoriana*** (DC.) Merr. — See p. 201.

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